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Full Length Research Paper

An analysis of the spatial pattern of activity transition in a traditional African city: A case study of Ilorin, Nigeria

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This paper analyses the spatial pattern of activity linkages of people in Ilorin especially the types, location and the spatial pattern of the linkages among the diverse activities. Data were collected from 500 residents of Ilorin, each of whom completed a time budget diary over one week. Descriptive statistics were used to summarize the data while probability transition analysis was used to analyse the linkages between the activities. The result shows that the activities were fixed in space and that there is no significant linkage between the activities. The study also shows clearly that spatial structure of activity in Ilorin is different from what occurs in Western cities where there is strict zonation in the usage of space. It therefore, follows that in planning facilities and infrastructures, they should be located in focal points because if there is a demonstrable linkage between two activities in space, it makes sense to locate the facilities housing them in the same space so as to eliminate time and energy consuming travel.

Key words: Spatial pattern, activity transition, traditional African city.

INTRODUCTION

Enormous amounts of interactions go on daily in urban centres. These interactions are among *people* through their *activities* at specific *locations,* for specific *durations.* Interactions in urban centres are therefore *multi-dimensional* and *complex*, involving activities, location, timing, duration and sequence. Existing urban land use patterns determines the spatial pattern of interactions among urban functions, which in turn determines future urban land use patterns. Studies of urban activity linkages through time and space are rare or nonexistent in developing countries (as far as we know). In developed and developing countries, studies of urban centres and functions are many and may be grouped into five categories as follows: Prediction of urban growth using ecology theories; locational factors of urban functions; explanations of interaction among urban functions using the concepts of complimentarity, intervening opportunities and transferability; explanation of the propensity of urban households to travel; and factors of urban households' residential location decisions through concepts such as (i) economic competition model of urban land use (Harris and Ullman, 1945; Hyot, 1945; Logan, 1966), and (ii) spatial interaction model (Ullman, 1957; Kansky, 1967).

In previous studies, the dimensions of interactions were treated distinctively, as if they were separate. Thus the link between people, activities, location and time is missing in these previous studies. This missing link is what this study seeks to provide. Against this backdrop, this study aims to examine activity linkages through time and space in Ilorin and their implications for urban land use policies. In doing so, the study will (i) identify the diverse activities of the people in the study area, their location, the times of the day the activities take place and their duration, (ii) differentiate between the activities of the people and the time spent on these activities based on their gender, education qualification, occupation, age and religion, (iii) determine the occurrence of a sequence of activities and linkages among various activities, and (iv) draw inferences from the study for land use policies for Ilorin and Nigerian urban centres at a similar stage of development.

A review of the large urban interaction literature yielded the following concepts and models around which the present study is constructed: (i) Models of urban activity pattern and activity system (Hagerstraand, 1969; Garling et al., 1996; Garling, 2001); (ii) Spatial behavioural models (Pred, 1967; Procos and Harvey, 1977; Pacione, 1982); (iii) Micro-behavioural model (Hanson and Schwabs, 1987; Hanson,

1992), and (iv) Spatial interaction model (Kwan, 1998, 2002, 2003). The variables that were derived from these concepts and models and about which data was collected in this study are (i) types of activities, (ii) time allocation to different types of activities and (iii) linkages between different types of activities.

THE STUDY AREA

When the present city of Ilorin was founded is not very clear. Indeed, little is known about its pre-jihad political development. Ilorin is the capital of Kwara State. It is located on latitude 80.30N and Longitude 40.35E. It lies on the southern fringes of the savanna region and north of the forest zone. Ilorin is located in the Guinea savanna grassland belt of middle belt region of Nigeria. The main river in Ilorin is the Asa which flows in a south-north direction. It divides Ilorin into two parts: A western part representing the core or indigenous area and the eastern part where the Government Reservation Area (GRA) is located.

Ilorin has experienced a rapid growth in its population over the years. The first population census in 1911 put the population of Ilorin at 36,343 while the 1953 population census put the town's population at 40,994. The 1963 and 1991 censuses recorded the population of the town as 208,546 and 532,088, respectively. The projected population of Ilorin in 2006s when this research was carried out was 748,150 based on an assumed annual growth of 3.5%.

METHODOLOGY

One major problem in spatio-temporal activity linkages research is that of data collection, especially when the objective is not to generate a voluminous database for every locale that will be randomly sampled and covered (Cressie, 1993; Bailey and Gatrel, 1995; Battelle, 1997; Abumere 2001, 2003), but to use disaggregate data for inductive modelling, involving the linkage of time and space in which the activities of a giving population take place.

Source of data

The activity network approach (ANA) was adopted for this study. ANA is a micro-behavioural, inductive approach that makes predictions about the whole from disaggregate data of the behaviour of individuals using time budget diary (TBD). TBD questionnaire focuses on the socio-economic attributes of the individual, types of activities, location of activities, beginning and end time of activities and number of participants in each activity (Procos and Harvey, 1977).

Sampling procedure

The 20 electoral wards in Ilorin formed the spatial framework for primary data collection. The use of these wards was based on the fact that it makes it easier to obtain data on population. The sample size was 500 literate individuals. This number was proportionally distributed among the 20 wards based on their 1991 population projected to 2006, using 3.5% annual growth rate. Number of respondents to be interviewed from each ward was randomly selected. This sample is considered adequate for the study of this nature because of the complexity of completing the questionnaire, the time and cost involved in administering the questionnaire, monitoring the respondents, and more importantly, because research involving time budget diary does not normally accommodate large samples (Timmermans, 2000; Kwan, 2005). Each respondent was issued seven copies of the TBD questionnaire, one for each day of the week. Research assistants monitored the respondents at home and work places.

Method of data analysis

Transition analysis was used to establish the link between types of activities and travel episodes. Transition probability matrix measures the number of times in which people move from activity *i* to activity *j* (*mij*) expressed as a proportion of the total number of times which activity *i* occurs. This is given by the equation:

$$Pij = Mij \sum mij:$$

where *Pij* = transition from point i to j; *Mij* = number of times people move from activity *i* to activity *j, and* $\sum mij$ = total number of times people move from activity *i to activity j*

MAJOR FINDINGS

Activities of the respondents

More than 1,000 different types of activities were listed by the respondents, but these activities could be classified into six major types, namely, educational, artisan/ technician, commercial, civil service/administration, financial and other services as shown in Table 1.

Of the six activities, those connected with education have the highest number of respondents (56.0%). This comprises both teachers and students in secondary and tertiary institutions. This is followed by commercial (22.0%), artisans/technicians (9.8%), civil service/ administration (7.38 %), and other services (3.0%) while financial activities recorded the lowest (1.3%).

Location of respondents' activities

The different types of activities that were listed by the respondents were re-classified under three major sub-headings that focused on where the activities took place or where the activities were located or based (Cullen and Godson, 1972; Procoss and Harvey, 1977; Kwan, 2006a). Home based activities in this respect refer to those activities that took place not only inside the houses of the respondents but also within the neighbourhood of the respondents, that do not involve long distance move-ment. Office/workplace based activities are those that look

Table 1. Occupation of respondents.

Occupation	No. of respondents			
	Male	%	Female	%
Civil service	50	15.4	76	23.40
Trading/business	30	9.20	43	13.20
Artisan/technician	27	8.30	5	1.50
Professionals	15	4.60	7	2.20
Students	44	13.50	24	7.40
Others	4	1.20	0	0
Total	170	52.30	155	47.70

Source: Field work, 2005.

Table 2. Location of activities.

Activity location	No. of respondents	%
Home based	149	47.5
Office/work place	162	51.1
Outdoor	2	1.4
Total	313	100.0

Source: Fieldwork, 2005.

the respondents out of their neighbourhood. It involves commuting to and from, using various modes of urban transport while outdoor activities on the other hand, are mainly recreational activities which may or may not take people out of their neighbourhoods. The location of the respondents' activities is almost shared equally between home based and office/work place based activities as shown in Table 2.

The reason for this is that outdoor activities is a reflection of affluence, since most of the respondents are low income earners, engaged in informal sector or personal businesses from morning till evening; they rarely have time for leisure activities.

Spatial allocation of time by place of activity and day of the week

Table 3 shows the spatial allocation of time to various activities that is, the mean duration of activities in minute from day 1 to day 7. The daily variation in the allocation of time by the location of activities clearly demonstrated that office/workplace based activities had a much greater average duration than the home based activities.

Activity linkages

On the average, there were 118 linkages by respondents between day 1 and day 7 as shown in Table 4.

There was no linkage between office/workplace and outdoor and between outdoor and office. In general, there are six types of linkages or combinations (from the three group of activities given as 3! = 3×2×1 = 6). These linkages are:

1. Home – office
2. Home – outdoor
3. Office – home
4. Office – outdoor
5. Outdoor – home
6. Outdoor – office

Activity transition

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Table 5 shows the linkages between different activities. It appears in this study that, home-office and office-home linkages are the major form of transition. This account for over 98.3% of all interactions, while the other interaction, home - outdoor and outdoor - home accounts for only 1.7% of linkages.

The linkage between various activities is presented in form of transition probability matrix. Transition probability matrix measures the number of occasions in which people move from activity (*i*) to activity (*j*) (*mij*) expressed as a proportion of the total number of occasions on which activity *i* occurs.

This is given by the equation:

$Pij = Mij\sum mij:$

where *Pij* = Transition from point i to j; *Mij* = number of times people move from activity *i* to activity *j, and* $\sum mij$ =

Table 3. Spatial allocation of time (mean duration of activity in minutes).

Days of week	Location of activities	Mean time spent	Standard deviation	% of Total sum
Sunday	Home based	544.24	181.90	56.6
	Office/work place	81.78	89.91	40.6
	Outdoor	85.71	.00	2.8
Monday	Home based	157.38	73.54	39.0
	Office/work place	704.3	86.04	61.0
Tuesday	Home based	166.38	80.40	37.5
	Office/work place	1037.24	104.51	62.5
Wednesday	Home based	151.0	73.04	46.6
	Office/work place	1325.12	109.39	53.4
Thursday	Home based	168.5	47.90	42.1
	Office/work place	995.4	148.71	58.0
Friday	Home based	132.04	56.85	47.0
	Office/work place	1045.52	114.61	53.0
Saturday	Home based	143.30	53.87	49.6
	Office/work place	1104.85	133.89	50.4

Source: Filed work, 2006.

Table 4. Linkages among activities.

Linkage	No. of linkage	%
Home-office	58	49.15
Home-outdoor	01	0.85
Office-home	58	49.15
Office-outdoor	0	0.0
Outdoor-home	01	0.85
Outdoor-office	0	0.0
Total	118	100.0

Source: Field work, 2005.

Table 5. Linkages between different activities.

Day	Home-office	%	Home-outdoor	%	Office - home	%	Outdoor - home	%	Total	%
1	5	4.24	1	0.85	5	4.24	1	0.85	12	10.17
2	8	6.78	0	0.0	8	6.78	0	0.0	16	13.56
3	9	7.63	0	0.0	9	7.63	0	0.0	18	15.25
4	9	7.63	0	0.0	9	7.63	0	0.0	18	15.25
5	7	5.93	0	0.0	7	5.93	0	0.0	14	11.86
6	10	8.47	0	0.0	10	8.47	0	0.0	20	16.95
7.	10	8.47	0	0.0	10	8.47	0	0.0	20	16.95
Total	58	49.15	1	0.085	58	49.15	1	0.85	118	100.0

Source: Field work, 2005.

number of occasion on which activity *i* occurs.

The probability transition matrix between various activities is presented in the Table 6. The analysis in Table 6 shows that transition between various activities is very low, and insignificant because with the exception of day 1 with transition 5, that is, outdoor to home that had the highest probability transition of 1, all others have a transition probability of less than 0.50, hence we can accept the null hypothesis that there is no significant linkage between different types of activities.

The poor linkages can be attributed to the following reasons. First; unlike in the advanced countries where there is a rigorous land use zonation into, residential, industrial, commercial etc and their strict enforcement, has clearly separated living areas from both residential and recreational areas. This does not hold much in traditional and medium sized towns where there is no clear land use zonation into residential, commercial and in some cases industrial land uses. Hence many people not only have their working places and residential areas co-existing in the same neighbourhood, but some peoples houses also serve as their work place or offices, hence there is no need to go out.

Secondly, people have regimented work life which is not structured, that is, they followed the same sequence and pattern working from dusk to dawn, hence people and activities lack linkages. This clearly differentiates third world cities from urban areas in advanced countries.

From the data collected and analysed in the study area, about 90% of the respondents had their activities fixed in space especially at home, that is, the pattern of activity is fixed in space because most of the respondents are engaged in informal sector and are self-employed. The population characteristics and the activity pattern that is fixed in space generated mainly home and office/work place based activities which the people have adjusted and accustomed to. The implication of this is that certain spaces would be in greater (or lesser) demand at a particular time. This forms the basis for the proposed model for this study.

A MODEL OF URBAN NEIGHBOURHOOD ACTIVITY CENTRES

Based on the aforementioned findings in the study area, we would like to construct a generalized model of land use planning and facility location in a traditional medium size urban center using Ilorin as a case study (Figure 1)

Given a medium size urban centre with its population, there would emerge various types of urban activity located in different parts of the city. The location of these activities would in turn generate activity pattern in space. The activity pattern itself would generate human spatial behavior. In the study area, the human behaviour in space was fixed. The fixity in human spatial behaviour is shared between home and office/work place. The urban neighbourhood activity centre model is of the view, therefore, that in planning for a medium size urban centre in developing world, there may be the need to adopt a strategy that would incorporate the behaviour of the people. Instead of strict land use zonation approach, facilities may be located closely to or around neighborhoods where people are fixed to. In this case and as demonstrated, facilities and infrastructures should be located between homes and work places. Obviously, if there is a demonstrable linkage between two activities in space, it makes sense to locate the facilities housing them in the same space so as to eliminate time and energy consuming travel (Adedokun, 2009a).

DISCUSSION

From the analysis of data in this study, about 90% of the respondents had their activities fixed in space. The implication of this is that certain spaces would be in greater (or lesser) demand at a particular time. In Western cities where specialized activities, high income and high automobile and mature transportation development are common, intensive and extensive population movement are a common feature. But Ilorin is a traditional town in a slow transition to a modern industrial – commercial town. The implications of the findings of this study for urban centers that are at this stage of development are as follows:

1. Planning for urban land use and activities should be approached from multidimensional dimension involving the population (people), their activities and locations (of the activities).
2. Allocation of land use and public infrastructures should be on the basis of opportunity maximization or constraint minimization to ensure optimality in land use; In other words, instead of strict land use, zonation into industrial, residential etc, this should be relaxed to give way to establishment of cottage industries and commercial centers within neighbourhoods.
3. In planning for new facility location and to ensure maximum use by the population, it is suggested that activities are located nearer to the people especially between home and work place since the major activity linkages is between home and office/work place. This would eliminate time consuming travels and would encourage people to participate in outdoor activities.
4. Also in planning land use and activity/facility location, the issue of accessibility and convenience should be taken into consideration. Since not all activity centers could be equally accessible, a trade off is often necessary. The ideal approach to land use planning and activities/facility location is to locate them at focal points to make them accessible to households. The household or respondent characteristics in this research would appear to favour neighbourhood location of activities; this will ensure optimality in land use and activity location.

Table 6. Activity transition probability matrix.

Day	1	2	3	4
1	0.016	0.003	0.152	1.000
2	0.026	0.000	0.243	0.000
3	0.029	0.000	0.273	0.000
4	0.029	0.000	0.273	0.000
5	0.023	0.000	0.212	0.000
6	0.033	0.000	0.303	0.000
7	0.033	0.000	0.303	0.000

Source: Author's analysis, 2006.

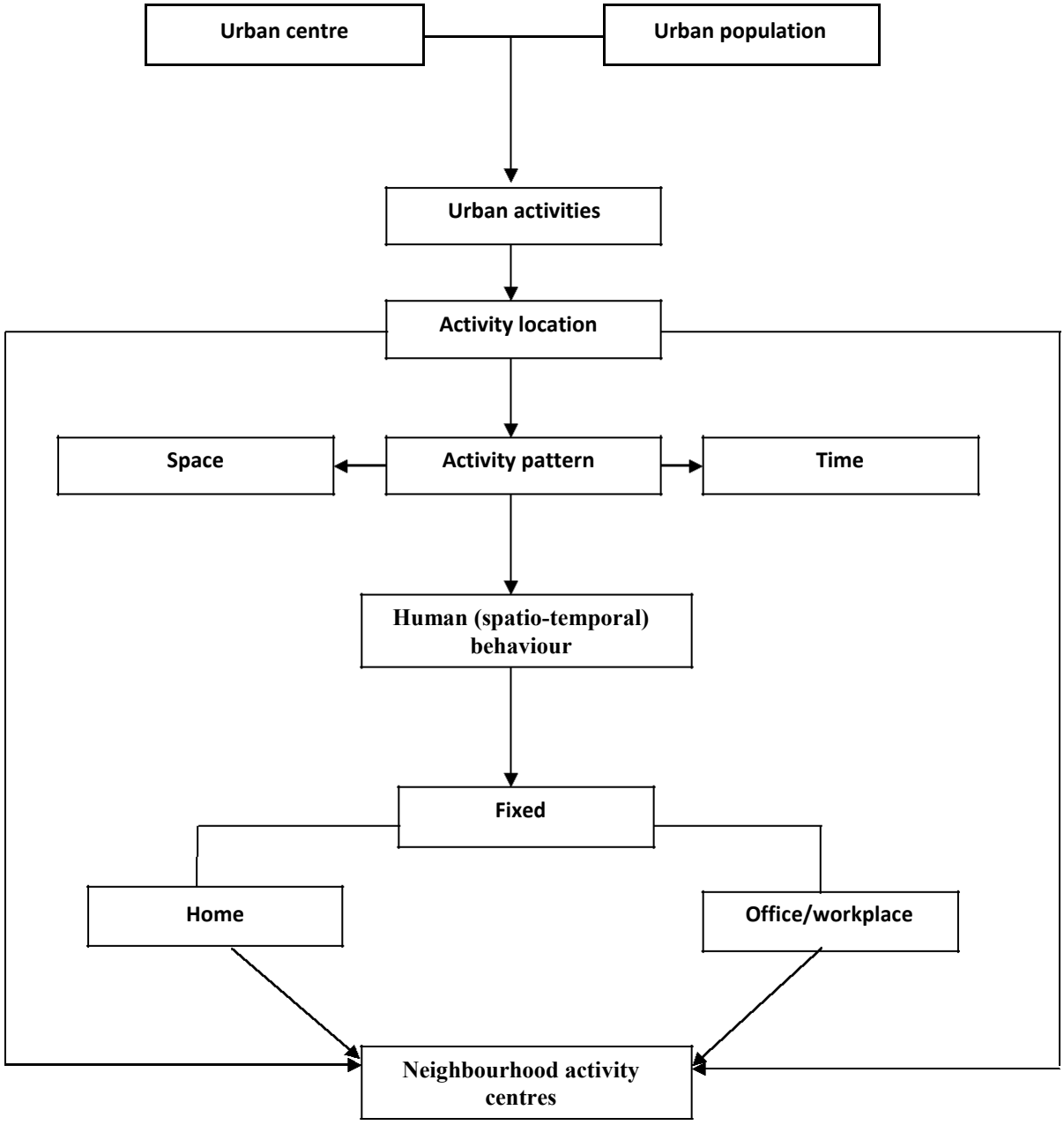

Figure 1. A model of urban neighbourhood activity centers.

Conclusion

The conclusion to be drawn is that over the years, studies on urban land use have been dominated by increasing mechanistic (mathematization) approach; better results have not been achieved. There is, therefore, the need for an active involvement of people who are directly concerned in issues relating to land use planning and activity location. Herein lies the importance of urban neighbourhood activity centers model proposed in this study (Figure 1). This model if implemented, especially in medium size traditional cities where modern day town planning theory is alien and unenforceable, will help to achieve efficiency and optimality in land use planning and activity location.

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