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# DETERMINANTS OF STRUCTURAL DIMENSION OF DAILY BEHAVIOUR IN A TRADITIONAL AFRICAN CITY: A CASE STUDY OF ILORIN, NIGERIA.

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**Abstract**
This paper analyses the determinants of daily temporal behavioral pattern of residents of Ilorin, especially the length of time spent on their 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 Principal Component Analysis was used to test the research hypotheses. The result shows that the activities were fixed in time and three variables: age, income and occupation were the major determinants of the time spent on the activities. The study also shows clearly that the temporal structure of activity in Ilorin is different from what obtains in Western cities where there is flexibility in the usage of time.

***Keywords:*** *behavioral pattern, activity data, descriptive statistics, Africa*.

## 1. INTRODUCTION

The study of how a given population spends their times on various activities is a complex one with many dimensions. These dimensions include the location, timing, duration, sequence and type of activities and or trips. These characteristics of time behaviour have made the analysis of its many dimensions imperative (Kwan, 2002, 2003). Previous researches have either focused on spatial dimensions (Main, 1982) or have completely ignored time element as if it is not important, though geographers view places in a two dimensional ways: space and time or spatio-temporal, they often tend to ignore the time element. This paper, thus, discusses the temporal pattern of activities, that is, the time spent on various categories of activities, the determinants of the time spent and its implication on urban infrastructural planning.

The approach of integrating individual spatial behaviour overtime was pioneered by Hãggertrand (1969). He used a simple diagram to illustrate his concept of space-time dimensions (Figure 1) Hãggertrand postulated the geographers' two-dimensional space on the surface of the earth or on the surface of a map. A line on this surface indicated movement in space but not in time. He suggested a third dimension to signify time.

 

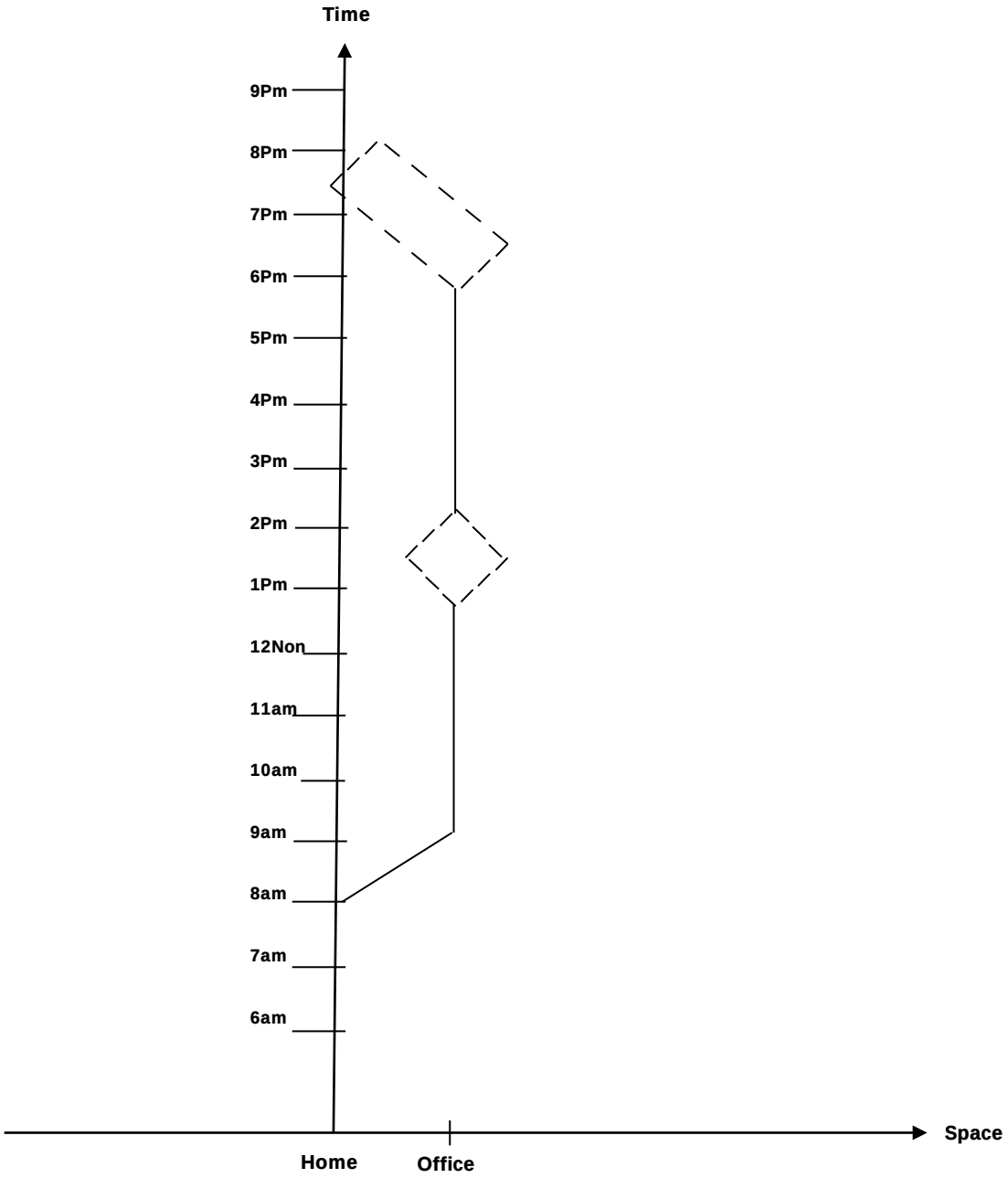


**Figure 1.** Man's daily space-time dimensions

*Source: Adapted from Haggerstrand (1969)*

Figure1 represents a very simple working day. Solid lines represent the path of all obligatory activities and dotted lines the prism or feasible regions of movement in periods for which there are no fixed activities. The worker is assumed to be effectively fixed at home until 7:30am to 8:00am where he can conveniently sleep and take breakfast. He must then take a direct route to work, where he is obliged to stay until lunchtime. During the lunch hour he has a certain amount of freedom; he must be back in the office exactly an hour. From 2pm until about 5pm he is again

 

expected to stay at work. But after 5pm he has no need to be home until 7pm for supper. In this period, 5-7pm, he can stay on at work or he can go somewhere near or stop off on the way back for a drink or visit. The main feature implicit in this model of daily behaviour is the idea that certain activities are fixed in both space and time.

## 2. 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 today the capital of Kwara State. It is located on latitude 80.30N and Longitude 40.35'E. 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 (Figure 2). The main river in Ilorin is the Asa which flows in the 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 2005 when this research was carried out was 748,150 based on an assumed annual growth of 3.5 percent.

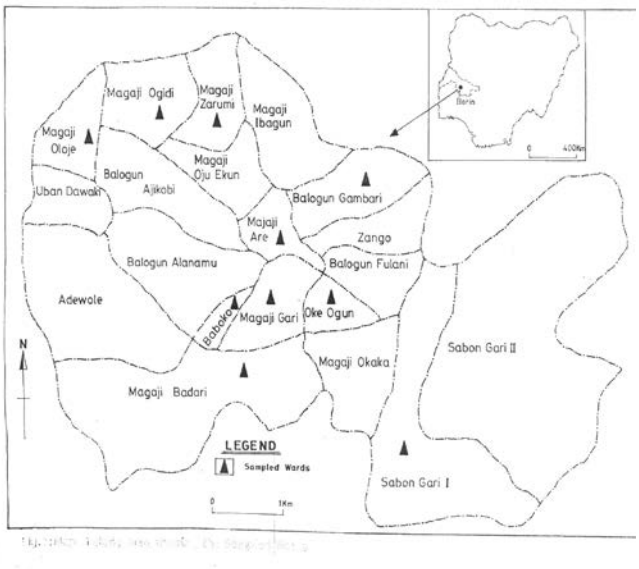


**Figure 2.** Map of study Area showing the Sampled Wards

## 3. METHODOLOGY

### 3.1. 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, number of participants in each activity, extent to which each activity was arranged and whether an individual could have done:

- anything else at the time of this activity,

 

- this activity at any other time,
- this activity elsewhere, and whether,
- been anywhere else at the time of his activity is taking place.

### 3.2. 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 percent 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 researches involving Time Budget Diary do not normally accommodate large samples (Timmermanns, 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.

## 4. MAJOR FINDINGS

### 4.1. Temporal Fixity of Activities

To establish the temporal nature (fixity) of the respondents' activities, they were asked whether they could have done anything else at the time they did a particular activity. The result shows that 280 respondents (94.6 percent) said they could not do anything else at the time while 16 (5.4 percent) indicated that they could do something else at the time. The temporal fixity of activities was further established when it was asked if these activities could be done at some other time The result shows that 8.5 percent of the respondent do not have their activity fixed in time. This include 7.4 percent, 0.7 percent in office/work place activities. On the other hand, majority of the respondents (91.5 percent) could not have done their activities at some other time. This includes 40.20 percent who are engaged in home based activities, 51.70% in office/work place activity and 0.7 percent in outdoor activities.

### 4.2. Relationship between Structural and Temporal Activity Fixity

Result shows that there is a relationship between the nature of activity, that is, whether an activity is arranged, planned, routine or unplanned and its temporal fixity. Structural fixity of an activity determines its temporal fixity. For instance, respondent could not perform "arranged" and "planned" activities at any other time. The few respondents (9.5 percent and 1.4 percent) who were engaged in arranged and planned activities could not have done them at any other time. Even in the case of routine activities, 248 respondents or 83.8% had their activities fixed in time.

Temporal fixity of activity also varies with the location of activity, that is, where the activity is based. 288 (97.3) of the respondents concerned could not have done anything else at that time i.e. they had their activity fixed in time. This comprises of 45.6 percent who were engaged in home based activities, 51.7 percent who were engaged in office/work place-based activities, and 0.7 percent who were engaged in outdoor activities. Only 8.0 percent respondents did not have their activities fixed in time, these were 6.0 percent and 0.2.0 percent who were engaged in home based and office/work place-based activities.

 

### 4.3. Temporal Pattern of Respondents' Daily Activities

This section discusses the temporal pattern, that is, the time spent on various categories of activities. Mean figures in minutes were used. The daily variation in the allocation of time by the location of activities shows that the respondents spent more time on home based activities. On the average, the weekly mean time spent on home based activity is 910 minutes while the weekly mean time spent on office/workplace based activity is about is 410 minutes. It is evident that although the location of respondent activities were almost equally shared between home and office/workplace based activities, more time were devoted to home-based activities with a mean of 910 minutes as against the mean of 410 minutes for work place based activities.

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Attempt is also made in the research to determine if there is any discernable group of behavioural pattern in any typical day. That is what are those variables that account for time devoted to activities each day of the week. To achieve this, factor analysis (principal component analysis) was used by subjecting a matrix of time which individual spent on each activity, each day to a factor analysis.

Both factor and principal component analysis are multivariate statistical techniques that reduce the dimensionality of a variable. Principal component analysis maximizes the variance accounted for in the original variable.( Abumere, 2001) From the data, there are three dependent variables i.e. (activity location, home, office/work place and outdoor). Out of these three only two (Home and office/work place) based activities were significant and extracted by the principal component analysis. There are six independent variables (gender, marital status, age

 

(years) religion, education qualification and occupation) of the six only two (age and income) are significant and extracted. For home based activities, the principal component analysis is presented inTable1

**Table 1.** Principal Component Analysis Derived from the Time Devoted to Home Based Activity.

| Component | Initial Eigevalues | | | Extraction sum of squared loadings | | | Rotation sum of squared loadings | | |
|---|---|---|---|---|---|---|---|---|---|
| | Total | % of variance | Cumulative % | Total | % of variance | Cumulative % | Total | % of variance | Cumulative % |
| **1** | 4.521s | 64.585 | 64.585 | 4.521 | 64.585 | 64.585 | 3.666 | 52.370 | 52.370 |
| **2** | 1.380 | 19.717 | 84.303 | 1.380 | 19.717 | 84.303 | 2.235 | 31.933 | 84.303 |

*Source: Authors analysis, 2006.*

From Table 1, component 1 has an initial equivalent of 4.521 and a percentage of variance value and extraction sum of squared loading percentage of variance value of 64.585 respectively and a sum of squares loading percentage variance of 51.650. While component 2 has an initial eigeun value of 1.380, extraction sum of squared loading percentage variance of 19.717 and rotation sum of squared loading percentage of variance as 31.933. Cumulatively, components 1 and 2 jointly account for 84.303 percent of total variance explained. But component 1 is more significant in explaining the variance (52.370).

However to properly explained dimensions of daily behaviour the components were rotated and transformed into coefficient of concurrence by squaring the component scores for each day as presented in the Table 2

**Table 2.** Transformed Component Score Matrix

| Time devoted to activity | Component Score | | | |
|---|---|---|---|---|
| | 1 | | 2 | |
| | Rotated score | Coeffiencient of concurrence | Rotated score | Coeffiencient of concurrence |
| **Day 1** | .833 | 0.694 | .167 | 0.028 |
| **2** | .934 | 0.872 | .204 | 0.042 |
| **3** | .946 | 0.895 | .158 | 0.025 |
| **4** | .777 | 0.604 | .326 | 0.106 |
| **5.** | .718 | 0.516 | .461 | 0.213 |
| **6.** | .212 | 0.045 | .958 | 0.918 |
| **7** | .200 | 0.040 | .961 | 0.924 |

*Source: Authors analysis, 2006.*

From Table 2, it is clear that for days 1 to 7, the structural dimension of daily behaviour as related to time devoted to home based activities, it is explained by component 1 (age of the respondents. This varies from 51.6 percent on day 5 to 60.4 percent for day 4, 69.4 percent for day 1, 87.2 percent day 2 and 89.5 percent on day 3). On days 6 and 7 variance is explained by component 2 (estimated annual income). This account for 91.8 percent on day 6 and 92.4 percent (the highest) on day 7.For office work place the variance explained by principal component analysis is presented in Table 3.

 

**Table 3.** Principal Component Analysis Derived for Time Devoted to office/workplace based

| Component | Initial Eigevalues | | | Extraction sum of squared loadings | | | Rotation sum of squared loadings | | |
|---|---|---|---|---|---|---|---|---|---|
| | Total | % of variance | Cumulative % | Total | % of variance | Cumulative % | Total | % of variance | Cumulative % |
| **1** | 5.856 | 83.655 | 83.655 | 5.856 | 83.655 | 83.655 | 5.850 | 83.577 | 83.577 |
| **2** | 1.001 | 14.294 | 97.949 | 1.001 | 14.294 | 97.949 | 1.006 | 14.372 | 97.949 |

*Source: Authors analysis, 2006*

From Table 3 the variance explained or the initial eiugenvalue and extraction sum or the squared loading are 5.856 respectively while initial eiugenvalue percentage of variance and the extraction sums of squared loading percentage variance is 83.655 respectively and the rotation sums of squared loadings percentage variance is 83,577. This is in contrast to component 2 initial eiugenvalues total of 1.001, percentage variance of 14.294, extraction sums of squared loadings percentage variance and rotation sum of squared loading percentage variance of 14.372 percentage variance of 14.372.

Overall, the two components 1 and 2 accounted for about 98 percent of total variance explained; however component 1 (age) is very significant in explaining the behavioral pattern in any typical day in the office/workplace because it contributed or accounted for about 84 percent while component 2 (estimated annual income contributed only 14 percent). The contribution of these two components in a typical day is displayed in the Table 4.

**Table 4.** Transformed Component Score Matrix for Office/workplace based activity.

| Time devoted to activity | Component Score | | | |
|---|---|---|---|---|
| | 1 | | 2 | |
| | Rotated score | Coeffiencient of concurrence | Rotated score | Coeffiencient of concurrence |
| **Day 1** | - | - | 1.00 | .100 |
| **2** | .986 | 0.97 | 0.173 | .030 |
| **3** | .992 | 0.98 | 0.141 | .020 |
| **4** | .978 | 0.96 | 0.200 | .040 |
| **5.** | .989 | 0.96 | 0.141 | .020 |
| **6.** | .992 | 0.98 | 0.141 | .020 |
| **7** | .987 | 0.97 | 0.173 | .030 |

*Source: Authors analysis, 2006.*

Table, 4 shows that for all days except day 1, the structural dimension of daily behaviour is explained by component 1. The component score and its transformation, the coefficient of concurrence varies from 96 percent for days 4 and 5, to 97 percent for days 2 and 7 and 98 percent for days 3 and 6 respectively. Component 2 (estimated annual income) only account for structural dimension of behaviour on day 1 and this is 100 percent.

As for outdoor activity, the computer analysis (result) shows a very insignificant account or contribution. The computer result states that there are fewer than two cases, and that at least one of the variables has zero variance. There is only one variable in the analysis, or correlation coefficient could not be computed for all pairs of variables, hence no further statistics could be computed for the file. This is because outdoor activities are a reflection of affluence. Due to poverty, people have to work from morning till evening of time without provision for leisure.

The results of the regression, ANOVA and factor analyses show that three variables: age, income and occupation affect time spent on activities. The explanation for this is that, most people are self-employed or they are having multiple occupations/combining many occupations

 

due to lack of formal employment, also most of the people are low-income earners. This is a major characteristic of Africa urban centers. It is an indication of the nature of activities in an emerging nation with a weak industrial base where informal activities dominate urban economic landscape. Also most people are self employed or they own their businesses hence these is no time table for their activities. Furthermore they have no structured work scheduled they work from morning till evening to make ends meet because their still within the active working population.

Based on the above findings in the study area, a generalized model of land use planning and facility location in a traditional medium size urban center, using Ilorin as a case study (Figure 3).

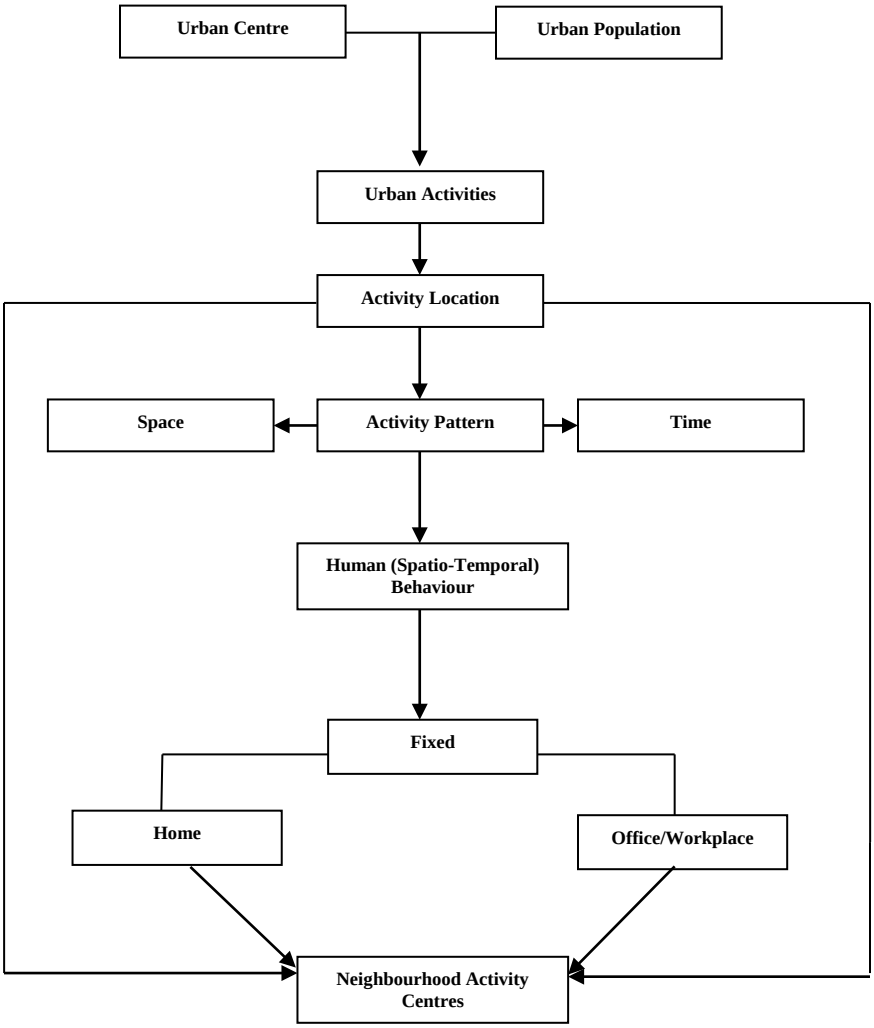


**Figure 3.** A Model of Urban Neighbourhood Activity Centers

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 with space and time (or spatio-temporal) dimensions. The activity pattern itself would generate human spatio-temporal behavior. In the study area, the human behaviour in space and time 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 time, it makes sense to locate the facilities housing them in the same space so as to eliminate time and energy consuming travel.(Adedokun, 2008, 2009)

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