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Semiological Analysis of Bura-Pabir Settlements: A Neighborhood Analysis Approach

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Abstract

Bura-Pabir land is geographically located in northeastern Nigeria, and it is a land punctuated by hills, valleys, and rivers. Numerous human settlements of the Bura-Pabir people also adorn the landscape, with each settlement showing a unique pattern shaped by the natural topography of the immediate environment and the preference of the clan that occupies the settlement. Through these factors along with the unique culture of the Bura-Pabir people, a settlement system has been created that has over time shaped the political and economic life of the people. To properly understand the extent of the interaction between the settlement patterns and the socio-economic culture of the Bura-Pabir people, it is important to analyze the geographic spacing and orientation patterns of the buildings and other structures which make up the settlement. It is in this regard that a nearest-neighbor analysis of the settlements is important. This study, therefore, fills this gap in the literature by making such an analysis.

Keywords

Settlements, Bura-Pabir, Kinfolk

1. Introduction: Bura-Pabir People and Settlements

The pattern of house settlement in rural areas has two separate but related components: the land division among its community and the community spatial arrangements. Thus, types of living in clusters are determined by the extent of the built-up areas and the compound layout space (Ewing and Cervero, 2001). Na-

turally, the pattern of fields is an important component of rural settlement and landscapes are an essential feature therefore the nearest neighborhood analysis principle is based on a comparison of the straight-line distances. Settlement is a unit of space built up by man to live and where to find a living Settlement serves man in several areas (Oluseyi & Joseph, 2018). The study is covering five Bura-Pabir[1] villages in Biu and Hawul local government areas of Borno State Nigeria. Kinfolk settlement was geometrical representing features and mythically symbolises anthropomorphic human figures, while architectural signs of abstract objects symbolise animals such as crocodiles, hyenas, etc.

As earlier said the Bura-Pabir people were said to have migrated from Yemen via Sudan through the Chad Basin (Kanem Borno region) to the present Bura-Pabir homeland in South-Western Borno state A.D 600. The Bura-Pabir kinfolks are Mandara Highlanders of the Sudan savannah region, a branch of the Chadic language group Greenberg (1963).

1.1. Statement of the Problem

There is no standard method of measurement between houses. The spatial arrangements of a compound depend on the number of a family that lived in it. The nearest neighborhood is used in calculating the distance between each compound and the distance between mud houses in a compound. Therefore, the problem statement in this study is the spatial distribution of the random settlement and its impacts on the vernacular architecture among the Bura-Pabir kinfolk (Onofrei, 2005).

1.2. Aim and Objectives of the Study

The study aims to analyse Bura-Pabir kinfolk settlements using a neighborhood analysis approach. The stated objectives of this study are as follows:

1) To determine the nature of the spatial distribution of land among the communities using neighborhood analysis.

2) To analyse semiological urban settlements in Bura-Pabir kinfolk.

1.3. Significance of the Study

The significance of this quantitative research study was to explore and describe the lived experiences of Bura-Pabir kinfolk using a neighborhood analysis approach as the guiding research methodology.

1.4. Scope of the Study

The study is limited to a hermeneutic phenomenology of the Bura-Pabir kinfolk using neighborhood analysis. The study is limited to 13 years from 2000-2023. The choice of the above time bracket is hinged on access to sources available.

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[1]Bura-Pabir is a Chadic language spoken in north-eastern Nigeria by the Babur/Bura people. Dialects include Pela, Bura Pela, Hill Bura, Hyil Hawul, Bura Hyilhawul, and Plain Bura. The language is closely related to Kilba, Chibok, Margi and a few other north-eastern Nigerian Languages.

1.5. Literature Review

Research work on the land-use/transportation interaction frequently uses the neighborhood as a synonym for the built environment or land use (Ewing and Cervero, 2001). Empirical studies of neighborhood effects across many disciplines (Sampson et al., 2002). Buck (2001) presented the conceptualization of neighborhood relating to the relationship between people and place. Theorists of the neighborhood generally agree that neighborhoods are both physical and social spaces. According to Onofrei (2005), the theory of architecture considers the whole sphere of architecture as a study matter and has application in-fields belonging both to practice and to knowledge. The complexity of the human need is made manifest in various noticeable attempts (Uji and Okonkwo, 2007). Okonkwo and Agbonome (2012) indicated that, because of the uncontrolled nature and planeness of the development, buildings may either come too close to one another or obstruct and conflict with one another settlements. Farmlands and compounds are traditionally organized (Maina, 2013). The study of vernacular architecture concerning family structure, norms, and the way space is constructed especially in domestic environments (Asquith, 2006). The analysis of human settlement patterns was performed using RS and GIS (Sarkar, 2010). The geographical, size, and morphological properties of rural settlement patterns in the Qinba mountains of the Chinese province of southern Shaanxi were studied by (Chen, Mehmood, Liu, & Gao, 2022). Their approaches involved the use of spatial measurement index, gradient transects, demographic-economic index, and detector analysis. One of the important findings of their work is the establishment of a significant positive correlation between the scale of rural settlement density, and high-value agglomeration characteristics. The pattern of growth in settlements in Oke-Ogun of Oyo State Nigeria between 1984 and 2011 was studied by (Olayiwola, Ajala, & Sangodipe, 2014). The study also predicted the future growth pattern by analyzing primary and secondary sources of data; the primary sources included GPS, Landsat TM, and ETM+ imageries, while the secondary sources included the administrative map and population data of the study area. Descriptive statistics and geospatial techniques were used for the analysis. Apart from these research efforts, several attempts have been made in the analysis of selected human settlement patterns by other authors. Table 1 shows a summary of some selected works of literature in this regard.

2. Methodology

The purpose of this quantitative research study is to explore and describe the lived experiences of the Bura-Pabir kinfolk, using neighborhood analysis approach as the guiding research methodology. A Survey sampling method is used in the selection of respondent's targeted kinfolk villages while a Stratified Sampling is based on dividing the settlements into strata, and the compound is selected randomly from these strata.

Table 1. List of selected human settlements pattern.

Author(s)	Title of work	Year	Methodology	Key finding(s)
		2022	**Weight set** involves setting the upper and lower bounds of indicators regarding relevant national standards, and indicator weight questionnaire APP of quality evaluation of urban-rural human settlements. **Standardization** involves using membership degree methods for standardizing the five indicators in terms of their grading target values.	Significant quality of urban-rural human settlements has occurred in China over the past 20 years, with decreasing tendency from the southeastern coastal area to the northwestern inland area spatially.
(Zhou et al., 2021)	Evaluation and analysis of the suitability of human settlement environment in Qingdao	2021	**An index system** having 10 index factors was constructed from natural and human factors. Exploration of the spatial aggregation and differentiation of the quality of the environment of human settlement, and the internal connection of spatial evolution.	A strong correlation exists between the quality of the human settlement environment and the degree of agglomeration.
(Wang & Zhang, 2021)	Analysis of the Evolution of Rural Settlement Pattern and Its Influencing Factors in China from 1995 to 2015	2021	Land data from satellite imagery was used for analysis, also used were socioeconomics, landscape pattern analysis, field data survey, kernel density estimation, and spatial measurement models.	The two-decade study period revealed the continuous weakening of the population agglomeration capacity of rural settlements in China; also, the shape and the structure of rural settlements became more complex and irregular for the period under review.

2.1. Research Method

The village boundaries within Biu **Figure 1** and Hawul **Figure 2** local government areas were digitized. A line-up criterion to identify and extract urban settlements from hamlets and villages selection were used. Data were manually extracted through the screen data capture procedure.

2.2. Population Data

The population of the villages is not available on the population census. Therefore, the population estimate provided is based on fieldwork.

2.3. Data Analysis

Spatial Statistical analysis techniques including multi-distance cluster analysis and spatial autocorrelation analysis were used to examine the nature of spatial distribution of six categories of the studied settlements.

2.4. Data Extraction

The research initially used the image segmentation approach of digital image processing techniques to extract land uses. Villages of study have different spatial arrangements while vegetation around residential buildings serves as outdoor farms. Consequently, the study adopted visual interpretation and on-the-screen

Figure 1. Block map of Biu Township.

Figure 2. Block map of Hawul Township.

data extraction for capturing the settlements from google earth.

1) **land use:** The criterion utilized the concentration of buildings (high density of buildings over a large area of more than 2 square kilometers.

2) **Access roads:** In this regard, Settlements are regarded as places that have link roads from the major trunk roads that lead to them or pass through them.

3) **Roof type:** Roof tones were used to differentiate settlements from circular, pith, and flat roof types.

3. Result of the Analysis

The study villages are Bamburatai, Marama, Puba, Sakwa, Tiraku, and Tsahuyam. The villages are further digitized using a similar method to Biu and Hawul.

The data in Table 2 of the six study villages are digitized maps in Figures 3-8.

The nearest distance between the compound was measured using the ruler tools on Google Earth. Nearest-neighbor distances are then extracted directly from google earth. From these, the mean distances of the compounds are calculated, and for each image, the sample is computed. The area of each rectangular sample image is then evaluated, and R_n values for each image sample are then computed.

The nearest neighborhood is used in calculating the distance between each compound and the distance between mud houses in a compound. The nearest neighborhood statistic is given by:

$$R_n = 2d_m \sqrt{\frac{N}{A}}$$

where, R_n = nearest neighborhood statistic;

d_m = mean observed nearest neighborhood distance between points;

N = number of points, and A = area concerned.

The computed values of R_n lie on a continuous scale that ranges between 0 and 2.15, where, 0 denotes complete clustering, 1.00 denotes random scatter and 2.15 denotes complete regularity, i.e., each point equidistant from six other points.

The R_n value in Table 3 Result of the analysis shows that Bamburai is clustered settlement, Marama is clustered settlement, Puba is randomly scattered, Tiraku is clustered and Tsahuyam is clustered. Roy (1972) carried out a similar study in India and obtained a remarkable result.

Table 2. Sample data of the study site.

Sample image	Latitude Extension		No. of settlement Selected randomly	Data area (sq·km)	Scale
	From	To			
A. Bamburatai	10˚59'37"	12˚3'56"	2	1.55	1:224,000
B. Marama	10˚45'18"	12˚16'35"	12	5.88	1:106,300
C. Puba	10˚26'33"	12˚22'23"	3	1.29	1:207,000
D. Sakwa	10˚30'0.46"	12˚12'9.32"	4	1.82	1:244,000
E. Tiraku	10˚29'26"	12˚21'30"	3	1.22	1:131,000
F. Tsahuyam	10˚30'29"	12˚8'57"	2	1.14	1:910,000

Table 3. Parameters of the settlements analysis.

Sample Data	No. of compound settlement	Area (sqm)	Nearest Neighbor Statistic	(R_n)	Pattern
A. Bamburatai	2	1.55	0.25	0.5680	Clustered
B. Marama	12	5.88	0.18	0.5143	Clustered
C. Puba	3	1.29	0.31	0.9455	Random Scatter
D. Sakwa	4	1.82	0.27	0.8005	Random Scatter
E. Tiraku	3	1.22	0.21	0.6586	Clustered
F. Tsahuyam	2	1.14	0.17	0.4503	Clustered

Figure 3. A. Bamburatai.

Figure 4. B. Marama.

Figure 5. C. Puba.

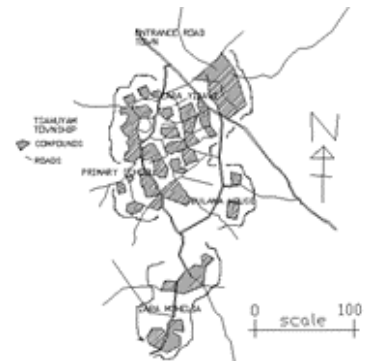
Figure 6. D. Sakwa.

Figure 7. E. Tiraku.

Figure 8. F. Tsahuyam.

3.1. Symbolism in Settlement

The data obtained in Table 3 using the nearest neighborhood formula in calculating the distance between each compound and the distance between mud houses in a compound. The parameters for the compound layout analysis of Bamburatai, Marama, Puba, Sakwa, Tiraku, and Tsahuyam are on Table 4. The result of the study is analysed based on the scale ranges between 0 and 2.15. See Table 4 below. The characteristic of the Bura-Pabir villages settlements is translated on geometrical rendering adopting (Lagopoulos, 1972) system of Semiological analysis of settlement classification.

Geometry is the branch of mathematics dealing with spatial relationships, measures, and properties of points, lines, and surfaces. In GIS applications, vector geometry is used to represent the spatial component of geographic features with discrete boundaries such as rivers states, etc.

To represent parts of the surface of the Earth digitized map representing it with a geometrical shapes chess board, rose flowers, fan wheel, etc., as an indication of what they represent.

Column (A) is the Bamburatai settlement representing a chessboard, this is a compact settlement where the settlements have a fair distribution stage.

Column (B) is a presentation of the Marama settlement on a chessboard, it is also similar to bamburatai of equal distribution by the kinfolk.

The geometric representation of the Puba settlement in column (C) radiates at the Centre but maintains a linear shape of settlements.

Sakwa settlement (D) is a rose flower in a ring form.

Column (E) is a geometrical representation of the Tiraku settlement in the shape of a clamshell. The settlement originates at the Centre then it radiates like a fan.

Column (F) is a geometrical representation of the Tsahuyam settlement in a shape of a rose flower in a ring form, with a peripheral neighborhood as the petals.

3.2. Anthropomorphic of the Mythical Settlements

These first anthropomorphic representations of the supernatural (attributing human characteristics to animals) which we observe in animism traditions with time gave way to zoomorphic representations of it. Zoomorphism was used for instance to provide a semi- or aniconic representation of the divine body as it helps to show its immanence on the one hand and transcendence on the other. Zoomorphic representation is located between the absence of any bodily form of the deity and absolute anthropomorphism. It should be mentioned that if the effect of anthropomorphism is to "familiarize their settlements" the deity makes it look like a human. The use of zoomorphic representations stresses the non-human aspects of deity, aspects that go beyond the human realm. These representations can be temporary (transformations to camouflage or show the power to transform) or constant. The last gives us examples of misanthropes bringing together humans and animals, they reveal the characteristics of the settlements (Kindt, 2019).

Table 4. A Theory of geometrical representation of maps.

| A. Bamburatai | B. Marama | C. Puba | D. Sakwa | E. Tiraku | F. Tsahuyam |
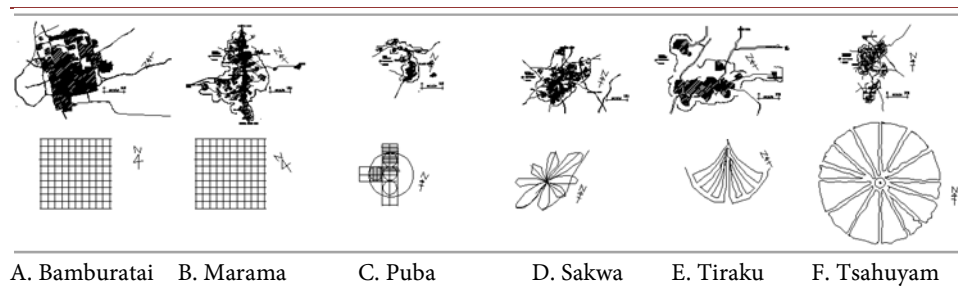
Thus, zoomorphic images in culture show the correlation between the natural and human reflecting the system of interrelation between the human society and the environment Medvedeva and Kolomiets (2020). They serve as points of cultural meaning concentration reflecting the complicated and controversial character of these interrelations. The zoomorphic hybrid is the representation of humans and employing its hybridization of nature and culture is reaffirmed (Medvedeva & Kolomiets, 2020). The analysis of the manifestation of zoomorphism in culture leads to understanding the bestial component in human nature and socio-cultural processes thus helping to solve such key problems of modern knowledge as the identification of human place in the society and formation of the world understanding in modern culture (Khramova, 2015).

The data obtained in Table 4 is an anthropomorphic of the six primordial settlements belonging to each part of the Bura-Pabir villages settlements Table 5 is a myth. The Bura-Pabir settlements consist of two peripheral neighborhoods. First is sal-mintar[2] (earth) quadripartite and mwala-minta[3] (world) quadripartite and one part of the human body.

Column (A) is anthropomorphic of the mythical representation of the Bamburatai settlement, of a man in a squatting position.

Column (B) is a representation of the Marama settlement. The anthropomorphic of Marama is a man in an upright position with his hand pointing to the sky.

The geometric representation of the Puba settlement. Column (C) is a man crawling on the ground.

Column (D) Sakwa settlement is an anthropomorphic is a man lying on the ground on his back position.

Column (E) is a representation of the Tiraku settlement. The settlement is a man in a bending position.

Column (F) is a Tsahuyam settlement originating at the center of the town in a ring form, and the anthropomorphic is a man in an upright position.
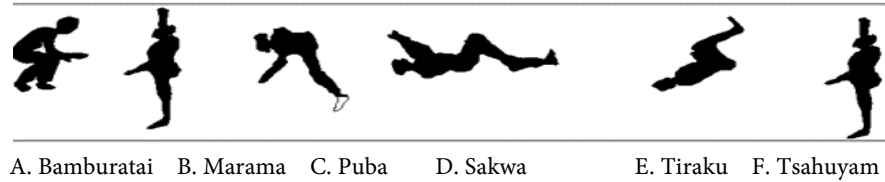
4. Discussion

4.1. Nature of the Spatial Distribution of Bura-Pabir Settlements

Settlement types describe the distribution of the population according to the

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[2]Sai-mintar: male gods.

[3]Mwa mintar: female gods.

Table 5. Anthropomorphic of the mythical settlements.

A. Bamburatai   B. Marama   C. Puba   D. Sakwa   E. Tiraku   F. Tsahuyam

population density and spread. The types of settlements are compact, semi-compact, and dispersed settlements. In compact settlements, the houses are close to each other, often joined, while in semi-compact settlements, there is a good amount of space between buildings. In dispersed settlements, there are few houses spread far apart. The following facts transpired from the analysis of Bura-Pabir settlements:

1) The size of the image samples varies in each of the village settlements: Settlement types describe the distribution of the population according to the population density and spread. The types of settlements are compact, semi-compact, and dispersed settlements. In compact settlements, the houses are close to each other, often joined, while in semi-compact settlements, there is a good amount of space between buildings. In dispersed settlements, there are few houses spread far apart. Settlement patterns describe the shape of population distribution in a rural environment. The main rural settlement patterns are linear, circular, triangular, and rectangular settlement patterns. The variation of the image sample and the R_n value obtain define a space settlement in all the six villages of study.

2) The image samples of their houses are circular and rectangular, and a few are closely square.

Geographic boundaries were defined to ensure that the data is reported in the most useful way that aligns with commonly understood, such as suburbs. To enable accurate comparisons with the Census Population and Housing, and other socio-demographic data. 2018 boundaries have been brought into alignment with the (Statistical Area), mud building, released by the GIS map.

4.2. Social Spaces

The notion of privacy represents a central criterion for both indoor and outdoor social spaces as reported by Azhar and Sabah (2014). In most traditional Bura-Pabir settlements, this study investigates privacy and everyday life as determinants of the physical properties and patterns of the built and urban. Social spaces in architectural projects in rural areas might be better designed around an enclosed compound than a roofed dwelling. Space within the compound is modified and designed for their daily activities such as holding a family meeting, eating together, marriage introduction, gisting, and relaxing and this differs with every society. The Bura people, just like every community, have their distinct culture and tradition.

4.3. Chessboard Model

A comparative series of some of the Bura-Pabir kinships may be considered cul-

turally and physically homogenous. Comparatively, the findings about the six towns' morphology, incorporating features unique to each location as a crucial part in the models of the traditional villages of some of the kinships of Bura-Pabir. A comparative table indicates the consistency of formal characteristics as well as variation in the village organization is discussed below.

4.4. Semiology Evaluation

The environment marks the villages sited on hills, villages sited on the rocks, and villages sited in valleys. The village habitat—it stated circular, linear, or oblong. The settlement pattern relates to contour, orientation, structure, and other characteristics. The last stage is the typology of habitation this includes small compound, large compound, medium compound, and modern structures Table 6.

Table 6. Kinfolk village's comparison table.

SITE STUDIED MORPHOLOGICAL CHARACTERISTIC	BAMBURATA	MARAMA	PUBA	SAKWA	TSAHUYAM	TIRAKU
ENVIRONMENT						
Villages highlanders	■	■	■	■	■	■
Hills and valleys	●●●●●	■	■	●●●●●	●●●●●	■
Forest vegetation's	■	●●●●●	■	■	●●●●●	■
VILLAGE HABITAT						
Direct river contact	●●●●●	■	■	●●●●●	●●●●●	■
Differentiation of land site	●●●●●	■	■	●●●●●	●●●●●	■
Forest enclave	■	●●●●●	■	●●●●●	●●●●●	■
Multi-loped pattern	■	■	■	■	■	■
Common ownership of land	■	■	■	■	■	■
SETTLEMENT PATTERN						
Circular	■	■	■	■	■	■
Linear	●●●●●	■	■	■	■	■
Parallel series	■	●●●●●	■	●●●●	■	■
Dense sectors	■	■	●●●●●	■	■	●●●●●
TYPOLOGY OF THE HABITATION AND STRUCTURES						
Small/medium compound	■	■	■	■	■	■
Large compound	■	■	■	■	■	■
Thatch covering	■	■	■	■	■	■
Entrance beneath the roof covering	■	■	■	—	—	—
Double looping roof	■	■	■	■	■	■
Corrugated iron covering	■	■	■	■	■	■

Present ■; Absent ● ● ●; No Available Information —.

The subscale of the design model above indicates that:

1) This study is designed to analyse the perceptions of kinfolk settlement in the village.

2) The magnitude of varying structure parameters varies from one village settlement to another. As seen in Table 6 in the examination of the field, both the typology of the habitation and structures and settlements plays a role in determining the magnitude of the field.

Spatial layouts of the study areas are based on a loose grid-like pattern of the settlements, for some parts allowing vehicular accessibility while in others because of the rocky terrain vehicular accessibility is difficult. The main reason given for preferring these areas over the city wards is what the respondents term the restrictiveness of the villages. When further clarification is sought most respondents would give accessibility, ease of house construction using local building materials, and room for expansion, as the reasons for their choice of living in remote villages. What could account for this strong perception of the restrictiveness of the older villages are values and norms, inadequate financial resources are contributing factors similar to the findings (Azizibabani & Bemanian, 2019).

4.5. Influence of the Environment

The geographical location of Bura land is located on the Biu Plateau, which are highlands in northeastern Nigeria, covering an area of approximately 2000 square miles (5200 square km) with an average elevation of 2300 feet (700 m). The plateau's highest point is Wiga Hill (2693) feet (821 m) and its most prominent relief features are the many well-defined, extinct volcanic cones.

The Bura-Pabir people are synonymous with highlands, they live on hills and are called highlanders. The terrain and the architecture developed by the people suit the environment and their social organization.

5. Conclusion

Neighborhood Statistical analysis techniques were used to examine the nature of the spatial distribution of different categories of settlements. The area covered by the settlements was used to classify the settlements into 6 classes based on modified natural breaks of sizes. Settlements are geometrically mythically classified in anthropomorphism using Lagopoulos (1972).

Recommendations for Further Study

The data in this research suggested a comprehensive study with an innovative method for understanding the complexities of kinfolk dwellings, spatial layout, and social relations: a critical review of the literature.

Contribution to the Knowledge

There are several benefits emanated from the result of the study, this includes:

1) The research identified settlements as significant to ancestral belief.

2) The research suggested that architectural projects in rural areas might be better designed around an enclosed compound than a roofed dwelling. Space within the compound is modified and designed to meet their daily activities.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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