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## RESEARCH ARTICLE

# Improving urban visibility through fractal analysis of street edges: The case of John Evans Atta Mills High Street in Accra, Ghana <sup>☆</sup>

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**Abstract**

Streets are a representation of cities, and the image of a city is a reflection of its home country. Although attempts to ensure harmonious spatial and environmental development in Ghanaian settlements date back to the colonial era, these efforts have minimal physical manifestation in the urban fabric of the city of Accra. The Independence Arch of Ghana, an important landmark in the urban fabric and history of Accra, lacks the striking vista and approach it deserves. This paper introduces the use of fractal analysis of street edges to understand the characteristics of the John Evans Atta Mills (JEAM) High Street for developing recommendations to improve visibility along its stretch and the overall image of the city. The box-counting method with visual survey was used in research. The pertinent questions this paper seeks to address are as follows: What factors affect the visibility and imageability of JEAM High Street? What design aspects should be considered to improve urban visibility along JEAM High Street? What is the link of fractals to urban design and architecture? The paper recommends various design considerations and qualities to improve the urban visibility and imageability of JEAM High Street.

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**1. Introduction**

Streets are a representation of cities (Jacobs, 1961), and the image of cities is a reflection of its country of origin (Lynch, 1960). These ideas had been well expressed in the urban planning philosophy of Rome in the 1500s, which was marked by numerous developments initiated by various

<sup>☆</sup>John Evans Atta Mills (21 July 1944–24 July 2012) was a Ghanaian politician, lawyer, legal scholar, and tax expert who served as President of Ghana from 2009 until his death in 2012.

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Popes (Grundmann and Fürst, 1998). Such developments were characterized by the demolition of haphazardly planned areas to bring forth a spatial axis of straight roads and bridges that physically and visually link one sacred place to another (Grundmann and Fürst, 1998). This approach to urban planning was conducted in a bid to restore the image of Rome from slow-paced development in the Middle Ages (Giedion, 1962).

In Ghanaian settlements, attempts to ensure harmonious spatial and environmental development date back to the colonial era. However, these efforts have minimal physical manifestations, which could have been the “result of ineffectiveness of the existing legislations and institutions set up to control development in the urban centers in Ghana” (Ahmed and Dinye, 2011). Building regulations, such as building height and sight lines, have also been disregarded (Opong and Brown, 2012). Disorientation is another factor that hampers the quality of perceived urban environments (Kalin and Yilmaz, 2012). By contrast, Lynch (1960) posits that heightening the imageability of an urban environment requires visual identification and structuring.

One example is the Independence Arch of Ghana in Accra, an important landmark that embraces the fabric and history of the city, although it lacks the striking vista and approach it deserves. The same issues are evident for the John Evans Atta Mills (JEAM) High Street in Accra. The elements implied that earlier paths, edges, landmarks, nodes, and regions are the building blocks of firm and differentiated structures at the urban scale (Lynch, 1960). JEAM High Street, which has the potential to visually link the Independent Arch to the Financial District and Old Accra, has street edges competing with corporate billboards and temporal commercial structures. Most striking of all is the abuse of sight lines along the street, which has resulted in the Independence Arch being downplayed as a mere landmark.

This issue of lack of visibility along JEAM High Street resembles that of St. Peter's Square in Rome, Italy before its redevelopment in the 1930s. JEAM High Street contradicts the views expressed by Lagarias (2007) wherein the visual experience of a city should be enriched by several major *vista* views and city elements, and of contrasting natural scenery.

This paper uses fractal analysis of street edges to understand the characteristics of JEAM High Street. Subsequently, recommendations are offered to improve visibility and imageability along JEAM High Street and the overall image of the city. Street edge refers to the outline of buildings and openings along a street as viewed in a plan. Fractals have long been documented in the literature, and they have been used to analyze street characteristics. However, fractal analysis has not been conducted on a single street with the aim of improving urban visibility. Therefore, the pertinent questions this paper seeks to address are as follows: What factors affect visibility along JEAM High Street? What design aspects should be considered to improve urban visibility along JEAM High Street? What is the relation of fractals to urban design and architecture?

This paper is organized into six sections. Following this introduction is an overview of a precedent study on the development of Via della Conciliazione (Conciliation Road), and an introduction to the concept of fractals and its link to architecture and urban design. The third section presents

the methodology, as well as a brief profile of JEAM High Street in Accra. The fourth section provides findings and discussions from the fractal analysis of JEAM High Street. The last section deals with the conclusion of the study.

The next section highlights a precedent study on St. Peter's Square in Rome and the concept of fractals as an analytical tool that is used to discuss the findings of the present work.

## 2. Theoretical framework

### 2.1. Development of St. Peter's Square at the Vatican City in Rome, Italy

In October 2015, a precedent study was conducted on Via della Conciliazione (St. Peter's Square in Rome, Italy) alongside Princes Street (Edinburg, Scotland) and Paradise Street (Liverpool, England) to theoretically explore the successful means of using street corridors as a way to create and improve urban visibility and legibility (Lynch, 1960).

Via della Conciliazione demonstrates how streets are used to frame historic buildings and monuments to create a monumental approach in street design. In addition, Princes Street presents the streetscape components of a successfully designed street corridor, while Paradise Street reveals the successful integration of transport and commerce within historic urban streets and corridors.

The theoretical framework in this section highlights Via della Conciliazione for better appreciation of JEAM High Street. In Accra, JEAM High Street has the potential to mimic Via della Conciliazione in Rome with respect to *genus loci*. The study was conducted by tracing the historical development of St. Peter's Square and the area along its eastern axis. The concepts and procedures used to conduct the development of St. Peter's Square and Via della Conciliazione were also explored.

**2.1.1. Urban redevelopment philosophy of Rome, Italy**  
The redevelopment scheme for Rome by Pope Sixtus V included plans to demolish a central row of housing, Spina Borgo Nuovo, in favor of St. Peter's Square (Figure 1). However, the demolition did not materialize until 1936 when former Italian leader Benito Mussolini instituted an urban plan to modernize Rome (Grundmann and Fürst, 1998).

Mussolini described his plan as an attempt to address the “necessities of the growing city and the lack of grandeur” of 20th-century Rome (Kostoff, 1973), where “necessities” referred to areas of interconnected housing. With respect to “lack of grandeur,” Mussolini further called for the “liberation of Rome from the mediocre construction that disfigured [it],” referring to Roman antiquity and Christianity, to create a monumental city of the 20th century (Kostoff, 1973). The vision of Mussolini was fulfilled with the construction of several grand highways that linked monumental nodes around the city (McClendon, 1989).

#### 2.1.2. History of Via della Conciliazione

Via della Conciliazione was constructed to celebrate the Peace Treaty of 1929, which was signed by Pope Pius XI, the leader of the self-governing Vatican City, and Mussolini (Coleman, 1999). Via della Conciliazione is a straight

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