Fractal Complexity in Cheikh Anta Diop's *Precolonial Black Africa*: A Pluridisciplinary Analysis

Introduction

Precolonial Black Africa: A Comparative Study of the Political and Social Systems of Europe and Black Africa, from Antiquity to the Formation of Modern States (1960/trans. 1987) is the first of Cheikh Anta Diop's five major works. The other four works that followed are *The Cultural Unity of Negro Africa* (1962), *The African Origin of Civilization: Myth and Reality* (1974a), *Black Africa: The Economic Basis for a Federated State* (1974b), and *Civilization or Barbarism: An Authentic Anthropology* (1981/trans. 1991).

Divided into a preface, ten chapters, a "postface" and a bibliography, *Precolonial Black Africa* is Diop's first attempt to reconstruct African history and the contributions of Black people to the foundations of Western civilization. The book compares the political and social systems of Black Africa and Europe from antiquity to the formation of modern states. Diop's intent is not necessarily to provide a history, but to provide guidelines for other scholars seeking a scientific comprehension of pre-colonial African societies, the Mediterranean and Europe, and their links with the earliest stages of human development. As the doyen of African American history, John Henrik Clarke, eloquently puts it, "Those who read this book seriously are in for a shock and a rewarding experience in learning. This is a major work by a major Back historian. At last, the renaissance of African historiography from an African point of view has begun, and none too soon" (Diop 1960/trans. 1987: back cover).

While my extensive search yielded 289 scholarly citations of *Precolonial Black Africa*, I found no scholarly book review or systematic analysis of the text, even though such potential exists (though I found one Blog post review by Chez Gangoueus 2008). This is a major gap in African Studies because Diop's text is the first systematic analysis to challenge the Eurocentric postulate that "African political life before the advent of the white man was virtually a miserable affair of tribal chieftains, primevally vicious, locked in primitive power struggles over deadly forest and savannah lands and sluggish streams that constituted their only sources of existence" (Awoonor 1990:1). This study is an attempt to fill this gap. Specifically, given the preceding postulate, I employ the mathematical concept of Fractal Dimension and Complexity Theory to explore the idea of spectrum progressing from more orderly to less orderly or to pure disorder in the text. This called for the utilization of the Pluridisciplianry approach that helped me to mix linguistics and mathematical approaches – more precisely, Linguistic Presupposition and Fractal Methodology. The results generated after the MATLAB computer runs suggest that the combination of negative and positive feedback loops, which form the basis of several African knowledge systems, also form a key mechanism of general self-organizing systems discussed in *Precolonial Black Africa*. Before discussing the results generated from the MATLAB computer runs, it makes sense to begin with an expose of the research methodology employed in this article.

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Research Methodology

The major challenge for me was how to transform the linguistic pragmatic or deep-level meanings in Diop's literary text for mathematical modeling. As I stated earlier, this called for the utilization of a pluridisciplianry approach that helped me to mix linguistics and mathematical approaches: more precisely, Linguistic Presupposition and Fractal Methodology. The following is a discussion of these techniques.

Pluridiciplinary Methodology

Pluridisciplinary Methodology can be generally defined as the systematic utilization of two or more disciplines or branches of learning to investigate a phenomenon, thereby in turn contributing to those disciplines. Noting that Diop had called on African-centered researchers to become pluridisciplinarians, Clyde Ahmed Winters (1998) states that a pluridisciplinary specialist is a person who is qualified to employ more than one discipline – for example, history, linguistics, etc. – when researching aspects of African history and Africology in general.

The history of the Pluridisciplinary Methodology can be traced back to the mid-1950s with the works of Diop and Jean Vercoutter. The approach was concretized by Alain Anselin and Clyde Ahmad Winters in the 1980s and early 1990s. A brief history of this development with brief backgrounds of these four pioneers is retold in the rest of this section.

G. Mokhtar in his book, *Ancient Civilizations of* Africa (1990), traces the development of Pluridisciplinary Methodology to the works of Diop and Vercoutter. Diop was born in Senegal on

December 29, 1923 and died on February 7, 1986. He was a historian, anthropologist, physicist, and politician who investigated the origins of the human races and pre-colonial African culture. His education included African history, Egyptology, linguistics, anthropology, economics and sociology. He is considered one of the greatest African intellectuals of the 20th Century. Jean Vercoutter was born in France on January 6, 1911 and died on July 6, 2000. He was a French Egyptologist.

According to Mokhtar, Diop and Vercoutter were in total agreement on the point that it is necessary to study, in as much detail as possible, all the genes bordering on the Nile Valley which were likely to provide fresh information. Mokhtar notes that Vercoutter considered it necessary to give due weight to the palaeoecology of the Delta and to the vast region which had been termed by other researchers as the 'Fertile African Crescent'. Mokhtar points out that Diop advocated tracing the paths taken by peoples who migrated westwards from Dârfur, reaching the Atlantic seaboard by separate routes, to the south along the Zaïre Valley and to the north towards Senegal, on either side of the Yoruba. He adds that Diop also pointed out how worthwhile it might be to study Egypt's relations with the rest of Africa in greater detail than had been done, and that he further mentioned the discovery, in the province of Shaba, of a statuette of Osiris dating from the 7th Century before the Christian era. Similarly, argues Mokhtar, a general study might be made of the working hypothesis that the major events which affected the Nile, such as the sacking of Thebes by the Syrians, or the Persian invasion of -522, had far reaching repercussions on the African continent as a whole (Mokhtar 1990:55).

Furthermore, according to Winters, two major scholars who have advanced the pluridisciplinary approach by combining anthropological, historical and linguistic methods to explain the heritage of African people, constituting a third school of Africancentric researchers (the first and second schools being the African American and the French-speaking African and African Caribbean, respectively), are Anselin and himself (Winters 1998). Anselin teaches ancient Egyptian linguistics at the University of Guyana Antilles. He is an anthropologist and also the founder of the *Journal of Caribbean Egyptology*. Winters is a lecturer at Governors State University in Illinois where he teaches curriculum design and research methods courses.

Anselin is the author of three important pluridisciplinary Africancentric books – (1) *Samba*, (2) *La Question Puele*, and (3) *Le Mythe d'Europe* – and numerous articles. In *Samba*, Anselin demonstrates how the corpus of Egyptian hieroglyphics explains both the Egyptian civilization and the entire world of the Paleo-Africans. He also makes it clear that Kemetic civilization originated in the Fertile African Crescent and that Black African and Kemetic civilization at its origination was unified from its foundations in the Sahara up to its contemporary manifestations in the languages and culture of Black Africans. In *La Question Puele*, Anselin examines the unity for Egyptian, West African and Dravidian languages, political traditions and culture. He also provides a detailed discussion of the "Black Ageans." The findings comprise a thorough representation of the affinities between the Agean and Dravidian civilizations (Winters 1998).

Winters is the only African American that attempts to confirm Diop's theories in relation to the genetic unity of the Egyptian, Black African, Elamite, Sumerian and Dravidian languages. Winters is mainly concerned with the unity of the ancient and new worlds' Black civilizations and the decipherment of ancient Black writing systems used by these Africans. This interest had led him to learn many languages, including French, Tamil, Malinke/Bambara, Chinese, Arabic, Otomi, and more (Winters 1998).

Winters had used Diop's genetic model in his research by combining anthropological, linguistic and historical methods to confirm that the center for the rise of the originators of the Egyptian and Manding civilizations, the Magyar or Hungarian civilization, the Dravidian civilization, and the Sumerian and Elamite civilizations was the Fertile Crescent of the highland regions of Middle/Saharan Africa. He also explains how Blacks founded civilizations in the Americas and East and Southeast Asia. A major finding from Winters' work is that the ancestors of the Dravidian and Manding-speaking people seem to have left Africa at the same time, around 2600 BC, and that these people founded civilizations in Europe, Elam, India and ancient China (Winters 1998).

Like Diop before him, Winters also discusses the African sub-stream in European languages, the conflict between African people and Indo-European-speaking people, and the loss of early African settlements in Europe to the contemporary European people due to natural catastrophes and wars around 1000 BC. Winters provides valuable source material for the elaboration of the African influence on European languages and those of East and Central Asia (Winters 1998).

Winters had discovered that the Proto-Saharan people used a common writing system. He also was able to read the ancient inscriptions left by these people in the Sahara, dating to 3000 BC. He was able to confirm this development by comparing the Manding and the Elamite languages, and the Sumerian and Dravidian languages. The evidence of a genetic relationship between the Manding languages, which Winters used to decipher the earliest Proto-Saharan writings and other languages spoken by the founders of civilization in India and Mesopotamia, led him to hypothesize that the writing systems used by these ancient founders of civilization could be deciphered. The utilization of Diop's linguistic constancy theory allowed Winters to confirm his own hypothesis and read the common signs used to write the Harapant, Minoan and Olmec scripts (Winters 1998).

Winters' most significant finding is the cognate language of Meroitic. By employing the evidence presented by the classical sources that the Kushites ruled empires in Africa and Asia, Winters is able to show that the cognate language of Meroitic was the Tokharian language spoken by the Kushana people of Central Asia. He has been able to decipher many Meroitic inscriptions by using the Kushana/Tokharian language (Winters 1998).

According to Dani Nabudere (2003), Pluridisciplinary Methodology involves the use of open and resource-based techniques available in an actual situation. Thus, it has to draw upon the indigenous knowledge materials available in the locality and make maximum use of them. Indigenous languages are therefore at the center of the effective use of this methodology.

What all this suggests, according to Nabudere, is that the researcher must revisit the indigenous techniques that take into consideration the episte-

mological, cosmological and methodological challenges. The researcher must be culture-specific and knowledge-source-specific in his/her orientation. Thus, the process of redefining the boundaries between the different disciplines in our thought process is the same as that of reclaiming, reordering and, in some cases, reconnecting those ways of knowing, which were submerged, subverted, hidden or driven underground by colonialism and slavery. The research should therefore reflect the daily dealings of society and the challenges of the daily lives of the people.

Towards this end, following Nabudere, at least the following six major questions should guide pluridisciplinary research (2003:13):

1. How can the research increase indigenous knowledge in the general body of global human development?

2. How can the research create linkages between the sources of indigenous knowledge and the centers of learning on the continent and in the Diaspora?

3. How can centers of research in the communities ensure that these communities become "research societies"?

4. How can the research be linked to the production needs of the communities?

5. How can the research help to ensure that science and technology are generated in relevant ways to address problems of the rural communities where the majority of the people live and that this is done in indigenous languages?

6. How can the research help to reduce the gap between the elite and the communities from which they come by ensuring that the research results are available to everyone and that such knowledge is drawn from the communities?

The truism that indigenous knowledge is critical to Africa's development prompted a workshop titled "Indigenous Knowledge Systems and Intellectual Property in the Twenty-First Century: Perspectives from Southern Africa" convened at the University of Botswana from November 26 to 28, 2003 which culminated into a book with the same title published in 2007 by CODESRIA. The tenor of the workshop and subsequent book is that the twin themes of indigenous knowledge systems and intellectual prop-

erty rights have moved to the center of academic discourse within the context of innovation and the commercialization of knowledge. This is because wealth is no longer reckoned in terms of physical assets alone. Unfortunately, the traditional imbalance between the North and the South, which has for long manifested itself mainly through trade, is replicated even in tapping intellectual property given to residents of the developing world who remain largely unable to define their property rights. Once again, the West exploits Africa and the rest of the developing world by expropriating indigenous knowledge systems and patenting them in the West (Mazonde and Thomas 2007).

Various scholars have suggested many major concepts to underlie the Pluridisciplinary Methodology, but it is Dan Nabudere (2003) who has provided the most succinct definitions and discussions for most of these concepts. They are as follows:

(a) African Spirituality refers to those aspects of people that have enabled them to survive as a human community throughout the centuries. It transcends European classical humanism with its class, socio-economic and geographical limitations based on Greece and the Athenian city-state, which is based on a system of slavery. African spiri-tuality leads to enlarged humanities and recaptures the original meaning of humanity which Western scholars, beginning with Plato, in their hollow and lopsided search for material progress, have abandoned (Nabudere 2003:3-4).

(b) Contemporary African Philosophy is a critique of the Eurocentric "idea" and "general philosophy" in its metaphysical perception that European-humanism is superior to that of the African people. This falsehood, which has been perpe-tuated by Europe to this day, hinges upon the belief that the rest of humanity has to be *forced* to believe like Europe in order to be "humanized" into a singular humanity. Contem-porary African philosophy seeks to "de-structure" this European pretext and emphasize humankind's "shared humanity" (Nabudere 2003:4).

(c) The African Renaissance is the initiative to recapture the basic elements of African humanism (*ubuntu,* 'eternal life', and 'immanent moral justice') as the path to a new humanistic universalism. This initiative, according to

Chancellor Williams, "is the spiritual and moral element, actualized in good will among men (and women), which Africa itself has preserved and can give to the world" (Nabudere 2003:4).

(d) The Pan-Afrikan University does not begin in a vacuum, for it has a deep heritage of culture and "civilizational" values that must inform its recreation (e.g., the Sankore University in Timbuktu). These institutions are to be found within Africa's ancient achievements. They must be unearthed and reclaimed. If the Pan-Afrikan University is to respond to this historic challenge and be a part of the correction of its historical distortion and theft of African heritages, it has to provide deeply thought out and well-conceived vision and mission, with a well articulated strategy to achieve its objectives. For it to be successful, it must be a part of the creation of a counter-hegemonic discourse which can enable the "triple agenda of deconstruction, reconstruction, and regeneration" to be undertaken at the same time. Consequently, the Pan-Afrikan University must develop the University as a new institution of higher education, which can help in reshaping the direction of education on the continent toward a more culture-specific and culturally relevant curriculum and pedagogy of liberation. It must draw from those heritages and provide the students, adult learners and the communities with a space in which they can learn as well as carry out their research and be trained by their teachers, community experts, and consultants at the university campuses as well as in the community knowledge sites. Essentially, the Pan-Afrikan University must be people-centered and community-based in which everyone enjoys the freedom to learn and speak (Nabudere 2003:5-6, 14).

(e) African Epistemology and Cosmology imply the development of an all-inclusive approach which recognizes all sources of human knowledge as valid within their own contexts. This calls for the adoption of hermeneutic philosophy in its African essence. This African-based epistemological and cosmological foundation is the prerequisite for the production and development of knowledge (Nabudere 2003:6-7).

(f) African Humanism/*Ubuntu* is a concept from the Southern African Nguni language family (IsiNdebele, IsiSwati/IsiSwazi, IsiXhosa and IsiZulu) meaning humanity or fellow feeling; kindness. *Ubuntu* serves as the spiritual foundation of African societies. It is a unifying vision or worldview enshrined in the maxim *umuntu ngumuntu ngabantu*: i.e. "a person is a person through other persons." This traditional African aphorism, which can be found in every corner of the continent, articulates a basic respect and compassion for others. It can be interpreted as both a factual description and a rule of conduct or social ethic. It both describes the human being as "being with others" and prescribes what that should be (Bangura 2005 & 2008).

(g) African Languages are at the center of developing the Pan-Afrikan University at all knowledge sites. Language, as Amilcar Cabral correctly pointed out, is at the center of articulating a people's culture. He stated that the African revolution would have been impossible without Africans resorting to their cultures to resist domination. Thus, culture is a revolutionary force in society. It is because language has remained an "unresolved issue" in Africa's development that present day education has remained an alien system. As Frantz Fanon put it, "to speak a language is to assume its world and carry the weight of its civilization". Kwesi K. Prah has argued consistently that the absence of African languages in the curriculum has been the "key missing link" in the continent's development. Consequently, the Pan-Afrikan University must build its curriculum on the basis of promoting African languages at the sites of knowledge and at the same time try to build libraries at those sites in the languages of the people living there. They must be promoted as languages of science and technology. This calls for the complete revamping of the epistemological and cosmological worldview of the current discourse. It also calls for the application of different methodo-logical and pedagogical approaches to learning and research in African conditions (Nabudere 2003:10).

(h) New Humanities is to serve as the core department in the division of the Pan-Afrikan University concerned with research and advanced studies. In the words of Chancellor Williams, the New Humanities "will have the task of enlisting the services of the world's best thinkers of the work of developing a science of humanity through studies expressly aimed at better human relations. It is to be at the heart of the entire education system and, therefore, the nation." Williams believes that the central idea in this philosophy is life. He argues that since neither Western science nor religion has provided satisfactory answers to three questions (From where do we come? Why? And where are we bound?), it is imperative for the Pan-Afrikan University to provide the space for discussing these eternal questions. This approach calls for the reorganization of the disciplines of the social and human sciences as well as the natural sciences into a holistic learning process. The reorganization should lead to a breaking down of the over-compartmentalization and over-fragmentation of faculties, departments and branches of knowledge. It should explore the reunification of allied disciplines (which have been subdivided into sub-disciplines) into unified fields of study (Nabudere 2003:14).

(i) Hermeneutic Philosophy recognizes the basic unity of human endeavor through "discourse" that expresses "the intelligibility of Being-in-the world" (Nabudere 2003:16).

(j) Integrated and Synthesized Knowledge is based on the notion that privileging African-centered curriculum must transcend a narrow conception of what is purely African to include such knowledge within the wider synthesized framework of global knowledge (Nabudere 2003:17).

(k) Afrikan-based Pedagogy draws inspiration and materials for learning from real life situations of the African people, especially in the rural areas, by adopting those pedagogical methods and techniques that inform their philosophy of life, their worldview, and their lived experiences and practices. The key to developing an Afrikan-based pedagogy hinges upon the knowledge specific-sites where African experts of different branches of knowledge are located. These sites will inform both the content and the pedagogy. The pedagogy will incorporate "oracy," which contains forms of art and techniques to which they give expression, which is essential for adult learning. By mainstreaming this form of expression, its agents gain visibility and recognition in knowledge creation and production. This will enable indigenous tales, stories, proverbs, legends, myths, symbols and epics to be resuscitated, for these forms of knowledge incorporate people's philosophies of life, norms, values in a kind of "moving" and "living library" (Nabudere 2003:19).

(l) *Life Long Learning*, which has recently become a mantra of many developed countries and international organizations as a novel approach to learning in the 21st Century, is deeply embedded within African culture and epistemology. Learning and "culturalization" in African societies were considered continuing processes that "took place from birth until death with the family unit, extended family, the village and the entire community participating" (Nabudere 2003:19). Life-long learning will bring adult learners to formal institutions of learning and remove the division between informal, non-formal, and formal education in line with African traditions and culture. It will also provide for the cooperation in research between the Pan-Afrikan University and the communities, in addition to providing for the recognition of learning outcomes gained through their own contexts outside the formal education system (Nabudere 2003:20).

(m) Kemetic Civilization is a Black African civilization whose origination in the Fertile African Crescent was unified from its foundations in the Sahara up to its contemporary manifestations in the languages and culture of Black Africans (Winters 1998).

The favored methodological approach for pluridisciplinary studies is Hermeneutics, an open-ended approach that permits cross-cultural communication and exchange of ideas and opinions to promote understanding between all knowledge systems in their diversities. This African philosophical-pedagogic approach hinges upon the acceptance of pluralism and cultural diversity. It stresses the need for the "fusion of historical horizons" as the best way of transmitting understanding between different lived histories or experiences of different communities as the basis of their

existence. It insists on both the cultural context and the historical contingencies of events as necessities for a true comprehension of the different lived experiences. Furthermore, the approach has its roots in the African/Egyptian mythical figure of Hermes, the messenger of knowledge from the gods to mortals and the interpreter of the divine message to humankind, and that is why Hermeneutics is named after Hermes (Nabudere 2003:7-8).

Hermeneutics is to be employed on the premises that encourage self-directed learning, which engages with the knowledge, interests, and real life situations that learners bring to their learning situations. This notion of site-specific knowledge attempts to offer a corrective to the Eurocentric tendency of universalizing knowledge around Occidental centers and sites of knowledge which are privileged to the disadvantage of others, claiming to be the only sites of "rationality" and "scientific knowledge". Recognizing the other sites and centers leads to a truly multi-polar world of global knowledge culled from all sources of human endeavor (Nabudere 2003:8).

Linguistic Presupposition as the Unit of Analysis

As stated earlier, the unit of analysis for the present essay is linguistic presupposition, which can be defined as an implicit assumption about the world or background belief upon which the truth of a statement hinges. The linguistic presuppositions for this study are drawn out of Diop's topics in the text examined. The writer's topics here are the a priori features, such as the clear and unquestionable change of subject focus, for defining types of linguistic presuppositions found in the text examined. While there are many other formulations of 'topic' from which to chose, the writer's topics are employed for this essay because it is the writer who had topics, not the text. The other formulations of 'topic' include sentential topics, discourse topics, presuppositional pools, relevance, topic boundary markers, paragraphs, paratones, representation of discourse content, position-based discourse content, and story. Thus, the notion of 'topic' in this article is considered as one related to representations of discourse content.

In choosing the writer's topic as the recording unit, the ease of identifying topics and correspondence between them

and the content categories were seriously considered. Guiding this choice was the awareness that if the recording unit is too small, such as a word, each case will be unlikely to possess any of the content categories. Furthermore, small recording units may obscure the context in which a particular content appears. On the other hand, a large recording unit, such as a stanza, will make it difficult to isolate the single category of a content that it possesses. For the current essay, two methods were appropriate. First, there is the clear and uncontestable change of subject focus. Second, topicalization was found to have been used to introduce new characters, ideas, events, objects, etc.

Finally, in order to ascertain the reliability of the coding unit employed for the essay, attempts were made to show inter-coder reliability: that is, two or more analysts, using the same procedures and definitions, agree on the content categories applied to the material analyzed. Two individuals, who had extensive training in discourse analysis and especially topic identification, were given copies of the text studied to identify what they perceived as topics, or more specifically, where one topic ends and another begins. Although there were no differences between the two individuals and I, the identified topics and the texts were also given to a linguist who has done a great deal of work on topic analysis for comments and suggestions. This approach was quite useful for increasing my confidence that the meaning of the content is not heavily dependent on his analysis alone.

After identifying the presuppositions in the text studied in terms of the topics identified, these propositions were placed into two categories ('order' versus 'disorder') based on the bottom-up processing approach common in linguistic analysis for further examination. This involved working out the meanings of the propositions already processed and building up composite meanings for them.

Because the text examined is a representation of discourse in text, the level of analysis is naturally the written text. Text is used here as a technical term – in Gillian Brown and George Yule's conceptualization, "the verbal record of a communicative act" (1983:6).

In order to ascertain the presuppositions in the text examined, the test known as Constancy under Negation Rule was

employed. This test is important because, following Gottlob Frege (1892/1952) and Peter Strawson (1952), presuppositions are preserved in negative statements or sentences. A researcher can therefore simply take a sentence, negate it, and see what inferences survive: that is, are shared by both positive and negative forms of the sentence. But because, as Stephen Levinson (1983:185) is quite correct in pointing out, "constancy under negation is not in fact a rich enough definition to pick out a coherent, homogenous set of inferences", the tests for presuppositional defeasibility (the notion that presuppositions are liable to evaporate in certain contexts) and the projection problem of presuppositions (i.e. the behavior of presuppositions in complex sentences) were also employed.

Consequently, in order not to necessarily presume the conclusions to be drawn, cues to the intent of the author of the text examined are 'deconstructed'. How, then, are these cues mapped out for the present essay? According to Herbert Paul Grice's (1975) characterization of meaning or non-natural meaning (which is equivalent to the notion of intentional commu-nication), intent is achieved or satisfied by being recognized. A sender's communicative intent becomes mutual knowledge to sender and receiver: that is, S knows that H knows that S knows that H knows (and so ad infinitum) that S has this particular intention. So following Roger Shuy (1982), it is necessary to begin by asking "What did the writers (here, Diop) do"? Thus, it is clearly necessary to look at specific topics developed by the author of the text analyzed. This is particularly true because, according to Wallace Chafe (1972) and Carol Kates (1980), the structure of intentions can neither be defined by the grammatical relations of the terms, nor the semantic structure of a text. Therefore, mapping out the cues to the intent of the author contained in the text analyzed called for: (a) identifying communicative functions, (b) using general socio-cultural knowledge, and (c) determining the inferences made.

Fractal Methodology

It is only logical to begin any discussion of Fractal Methodology with a definition of what a fractal is. As I state in my book, *Chaos Theory and African Fractals* (Bangura 2000:6), the concept of fractal remains inexplicably defined. This shortcoming is pointed out by Philip Davis as follows,

albeit he himself does not provide and explicit definition: "I consulted three books on fractals. Though there were pictures, there was no definition" (1993:22). The following is a small sample of the various ways the concept of fractal has been described as provided by Lynn Steen:

> The concept of fractional dimension, or fractals, was developed in order to describe the shapes of natural objects....An interesting property of fractal objects is that as we magnify a figure, more details appear but the basic shape of the figure remains intact (1988:409).

In addition, according to Steen:

> The word 'fractal' – coined by Benoit B. Mandelbrot – is related to the Latin verb *frangere*, which means "to break." The ancient Romans who used *frangere* may have been thinking about the breaking of a stone, since the adjective derived from this action combines the two most obvious properties of broken stones – irregularity and fragmentation. The adjectival form is *fractus*, which Mandelbrot says led him to fractal (1988:420).

Furthermore, as Steen points out, "Fractal dimension (is) a measurement of the jaggedness of an object" (1988:413).

Keith Weeks (in Hargittai and Pickover, 1992) states:

> [J. E.] Hutchinson laid the foundations of a certain concept of self-similarity, the basic notion being that of the object made up of a number of smaller images of the original object, and so on ad infinitum, typically resulting in detail at all levels of magnification, a trait commonly associated with objects referred to as *fractals* (1992:107).

From the preceding descriptions, I venture to offer a general definition of a *fractal* as a self-similar pattern: that is, a pattern that repeats itself on an ever diminishing scale.

As for Fractal Methodology, more popularly referred to as Fractal Analysis, itself, with its applications in the social sciences, Clifford Brown and Larry Liebovitch in their recent work appropriately titled *Fractal Analysis* (2010) published as part of the Sage Publications Quantitative Analysis of the Social Sciences series have a succinct exposé on the subject. The rest of the discussion in this section is based on their work.

Brown and Liebovitch begin by stating that several early applications of fractal mathematics emerged in the social sciences. These works include Vilfredo Pareto's 1897 study of the distribution of wealth; Lewis Fry Richardson's 1948 and 1960, but published posthumously, study of the intensity of wars; and George Zipf's 1949 studies of the distributions of word frequencies and city sizes. Brown and Liebovitch argue that while these ideas were known by experts in the field, they were isolated, quirky concepts until Mandelbrot developed the unifying idea of fractals in the 1970s and 1980s. Since that time, however, in spite of the fact that Zipf and Pareto distributions represent fractal distribution, social scientists have lagged behind the physical and natural sciences in utilizing fractal mathematics in their works (Brown and Liebovitch 2010:ix).

Brown and Liebovitch observe, however, that in recent years, the application of fractal mathematics by social scientists in their studies has grown exponentially. Their variety, they note, has expanded as rapidly as their numbers. They cite the examples that fractal analysis had been employed by criminologists to investigate the timing of calls for assistance to police, by sociologists to investigate gender divisions in the labor force, and by actuaries to study disasters. The surprising range of fractal phenomena in the social sciences led Brown and Liebovitch to call for a comprehensive survey that would investigate the common threads that unite them, thereby leading to a broader understanding of their causes and occurrences (Brown and Liebovitch 2010:ix).

According to Brown and Liebovitch, if a researcher has rough data, strongly nonlinear data, irregular data, or data that display complex patterns that seem to defy conventional statistical analysis, then fractal analysis might be the solution to the researcher. They posit that the non-normal and irregularity of so much of social science data apparently are the result of the complexity of social dynamics. Thus, for them, fractal analysis offers an approach for analyzing many of these awkward data sets. And more importantly, they note, the method also offers a rational and parsimonious explanation for the irregularity and complexity of such data. They insist that the data are not behaving badly; instead, they are simply obeying unexpected but common rules of which we are unaware (Brown and Liebovitch 2010:1).

Brown and Liebovitch go on to conceptualize fractals as *"sets* defined by the three related principles of 'self-similarity', 'scale invariance', and 'power law relations'". They postulate that when these principles converge, fractal patterns form. They note that the statistic called 'fractal dimension' is employed to capture the essential characteristics of fractal patterns. They add that much empirical work in fractal analysis focuses on two tasks: (1) showing that fractal characteristics are present in a particular data set and (2) estimating the fractal dimension of the data set. They also mention that there are various techniques for implementing these two tasks (Brown and Liebovitch 2010:2), the discussion of which is beyond the scope of the present essay. Nonetheless, it is necessary to provide brief definitions of the preceding five italicized concepts based on Brown and Liebovitch's work for the sake of clarity. The significant fact about sets is that almost all data sets can be fractal: that is, points, lines, surfaces, multi-dimensional data, and time series. Since fractals occur in different types of sets, various procedures are required to identify and analyze them, with the approach hinging upon the kind of data (Brown and Liebovitch 2010:2-3).

Brown and Liebovitch define 'self-similarity' as a characteristic of an object when it is composed of smaller copies of itself, and each of the smaller copies in turn are made up of yet smaller copies of the whole, and so on, *ad infinitum*. The word 'similar' connotes a geometrical meaning: that is, objects that have the same form but may be different in size (Brown and Liebovitch 2010:3).

'Scale invariance' for Brown and Liebovitch refers to having the same characteristics at every scale of observation. Thus, when one zooms on a fractal object, observing it at ever-increasing scale of magnification, it will still look the same (Brown and Liebovitvh 2010:5).

According to Brown and Liebovitch, 'power law relations' denote the rule that for a set to achieve the complexity and irregularity of a fractal, the number of self-similar pieces must be related to their size by a power law. Power law distributions are scale invariant because the shape of the function is the same at every magnitude (Brown and Liebovitch 2010:5).

Finally, Brown and Liebovitch characterize 'fractal dimension' as the invariant

parameter that characterizes a fractal set. An analyst uses the fractal dimension to describe the distribution of the data. It is akin to having a "normal" set of data and using the mean and variance to describe the location and dispersion of the data (Brown and Liebovitch 2010:15).

Data Analysis

Before engaging in the fractal analysis of the data generated from Diop's text, I will first discuss the descriptive and inferential statistics employed to analyze them. Before computing the univariate and bivariate statistics to do the descriptive and inferential analyses of the data teased out of Diop's text, a two-dimensional ad hoc classificatory system was developed within which the data were categorized. The first of these categories entails the presuppositions of 'order': that is, presuppositions that suggest a condition of logical or comprehensible arrangement among the separate elements of a group. This type of presupposition is triggered by presuppositional discourse stretches such as "The *gér* comprise the nobles and all freemen with no manual profession other than agriculture, considered a sacred activity," "The *néno* comprise all artisans: shoemakers, blacksmiths, goldsmiths, etc. These are hereditary positions," and "the specific feature of the system therefore consisted in the fact that the manual laborer, instead of being deprived of the fruits of his labor, as was the artisan or the serf of the Middle Ages, could, on the contrary, add to it wealth given him by the 'lord.'" The second category encompasses presuppositions of 'disorder': that is, presuppositions that suggest a condition or place of confusion, mess, disturbance, disarray, or muddle. This type of presupposition is triggered by presuppositional discourse stretches such as "There were, of course, also palace revolutions," "The Almoravides besieged Aoudaghast and Ghana,'" and "the order was scrupulously carried out; the market of the Beni-Asbih was pillaged, as well as the wealth of the Draa region."

After computing the descriptive and inferential statistics, the data were then plotted for oscillations between 'order' and 'disorder' in the book. This technique made it possible to show visually the attractor reconstruction for the text.

As shown in Table 1, a total of 2,139 topic entries were teased out of Diop's texts. Of these, I categorize 1,484 or 69 per cent as presuppositions of 'order' and 655 or 31 per cent as presuppositions of 'disorder'. There are more presuppositions of 'order' than presuppositions of 'disorder' for the preface and eight chapters with emphases on Africa and more presuppositions of 'disorder' than those of 'order' in the two chapters with emphases on Europe. The mean for the 'order' category is about 135 presuppositions, with a standard deviation of approximately 107 presup-positions; the mean for the 'disorder' category is about 60 presuppositions, with a standard deviation of approximately 38 propositions. The range for the 'order' category is 322 presuppositions and that for the 'disorder' category is 133 presuppositions, while the variance for 'order' is about 111,501 presuppositions and that for 'disorder' is approximately 1,458. This means that there are more (in fact slightly more than twice as many) and statistically significant topic entries for presuppositions of 'order' than there are of those for 'disorder'. Moreover there are significant variations among the chapters for each category in terms of topic entries, as can be gleaned from the ranges. Still, given the significant number of presuppositions of 'disorder' in the text in every chapter, it is therefore not tenable to assert that Diop engaged in "romanticizing" about the African past, as some of his critics like Stephen Howe (1999) and Tunde Adeleke (2009) suggest.

From Table 2, it can be seen that there is a statistically significant difference between the topic entries for 'order' and those for 'disorder' at the 0.01 level. It is also evident that there is a statistically strong and positive correlation between the two dimensions at the 0.01 level as well. Even though the 'order' dimension is dominant, but as it increases, so does the 'disorder' dimension.

As can be seen from Figure 1, a log-log plot (or log-log graph) was employed to represent the observed units described by the two-dimensional variable encompassing *order* (y) and *disorder* (x) as a scatter plot/graph. The two axes display the logarithm of values of the two dimensions, not the values themselves. If the relationship between x and y is described by a power law,

$$y = x^a;$$

then the (x, y) points on the log-log plot form a line with the slope equal to a. Log-log plots are widely used to represent data that are expected to be scale-invariant or fractal because, as stated before, fractal data usually follow a power law.

A logarithm is an exponent. It is illustrated in the following definition:

For $b > 0$, $b \neq 1$ and for $x > 0$,

$y = \log_b x$ if and only if $b^y = x$

Thus, since a logarithm is an exponent, it is easy to use exponent laws to establish mathematical generalizations.

Figure 1 illustrates the fractal dimension of the two-dimensionality of the variable. The binary logistic statistics reveal that the relationship between the two dimensions is statistically significant at the 0.01 level. In sum, Diop's text moves halfway across the spectrum – it typically moves from periodic fractal, rather than stretching all the way to pure order or disorder. In essence, the results generated after the MATLAB computer runs suggest that the combination of negative and positive feedback loops, which form the basis of several African knowledge systems – as Ron Eglash (1999:173-4) suggests, also form a key mechanism of general self-organizing systems discussed in *Precolonial Black Africa*.

Indeed, the preceding findings seem to be in line with my inclusion of Diop in the school of thought I characterize as *åtenu* in Ancient Egyptian/Hieroglyphics or *Mapinduzi* in Kiswahili or Revolutionary in English, as opposed to either the *åtenu m'þen* in Ancient Egyptian/Hieroglyphics or *Mapinduzi ya Malazi* in Kiswahili or Revolutionary-Accommodationist in English, or the *khêperu* in Ancient Egyptian/Hieroglyphics or *Kubadilisha* in Kiswahili or Reformist in English, in my paper titled "Pan-Blackist Conceptualizations of the Black Power Paradigm: From Cheikh Anta Diop to Ali Al'amin Mazrui" (2010). In the paper, I define these concepts in the essay as follows: the term *åtenu* was employed by Ancient Egyptians to describe revolutionaries, rebels or fiends who wanted radical change. Such people were perceived as *Mesti*, the divine parents of the God of Sun or Day Râ; *Mesu*, the gods who begat their own fathers or divine beings; and *Mesut*, children of God Osiris or divine beings. The concept *åtenu m'þen* was employed by Ancient Egyptians to refer to those who wanted change but would accept things, listened to, obeyed, or be content with things as long as their burdens were assuaged. The word *khêperu* for Ancient Egyptians described

**Table 1:** Univariate Statistics by Types of Presuppositions in the Text

Chapter	Number of Topic Entries for Presuppositions of Order		Number of Topic Entries for Presuppositions of Disorder	
	N	%	N	%
Preface	6	67	3	33
1. Analysis of the Concept of Caste	87	71	36	29
2. Socio-political Evolution of the Ancient City	55	44	70	56
3. Formation of the Modern European States	30	40	45	60
4. Political Organization in Black Africa	328	71	136	29
5. Political Organization	327	77	98	23
6. Economic Organization	182	65	98	35
7. Ideological Superstructure: Islam in Black Africa	95	66	48	34
8. Intellectual Level: Teaching and Education	141	71	57	29
9. Technical Level	116	81	27	19
10. Migrations and Formation of Present- Day African Peoples	117	76	37	24
Totals Scores & Mean Percents = 2,139 or 100%	1,484	69	655	31
Mean	134.91		59.55	
Standard Deviation	107.244		38.187	
Range	322		133	
Variance	111,501.291		1,458.273	

Source: Self-generated data from the text and computed by using MATLAB

those who sought change in form, manifestation, shape, similitude, or image.

Figure 1: Log-log Plot Order vs. Disorder in the Text Binary Logistic: $y = 2.368 + 0.503$
$R^2 = 0.711; p = 0.001$
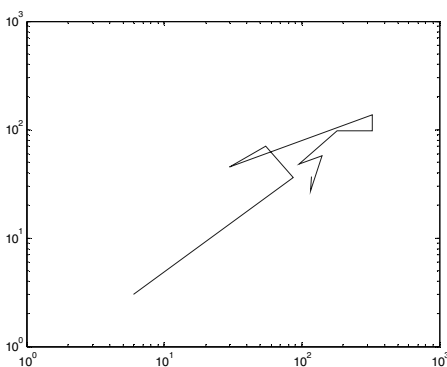
Source: Self-generated data from the text and computed by using MATLAB

The preceding designation is also evident in Diop's book titled *Black Africa: The Economic Basis for a Federated State* (1974b) when he discusses Black Power, which he says hinges upon the origins and history of the Black world. He asserts that in all likelihood, present-day African people are in no way invaders from another continent; they are the aborigines. He notes that scientific discoveries that show Africa to be the cradle of humanity increasingly negate the hypothesis of Africa being peopled by outlanders. He points out that from the appearance of *homo sapiens* – from earliest prehistory until our time – we are able to trace our origins as a people without significant breaks in continuity. In early prehistory, a great South-North movement brought the African peoples of the Great Lakes region into the Nile Basin. They lived there in clusters for millennia. He notes that in prehistoric times, it was Africans who created the Nilotic Sudanese civilization and what we now know as Egypt (Diop 1974b:3).

Diop therefore calls for a Pan-African Union on the basis of historical, psychological, economic and geographical unity. He urges us to complete such a unity and set it on a modern autochthonous cultural base to recreate our linguistic unity through the choice of an appropriate African tongue promoted to the influence of a modern cultural language. He concludes by stating that linguistics dominates all national life; without it, national cultural unity is but fragile and illusory, as the wrangling within a bilingual country, such as Belgium, illustrates the point (Diop 1974b:7-8).

It is therefore not surprising that Diop, the historian, anthropologist and physicist, was also a radical politician. From 1961 until his death in 1986, Diop launched three political parties that formed the major opposition in Sénégal. In 1961, he formed his first political party, *Le Bloc des Masses Sénégalaises.* By 1962, Diop's party, working on the ideas mentioned in his book titled *Black Africa: The Economic and Cultural Basis for a Federated State* (1974b), became a serious threat to the regime of President

Table 2: T-Test: Paired Samples Test and Correlations

Pair 1: Order-Disorder	Paired Differences
Mean	75.36
Standard Deviation	77.801
Standard Error Mean	23.458
95% Confidence Interval of the Difference	
Lower	23.10
Upper	127.63
t-Statistic	3.213
Degrees of Freedom	10
Significance (2-tailed)	0.009
Pair 1: Order and Disorder	**Paired Samples Correlation**
Correlation	0.843
Significance	0.001

Source: Self-generated data from the text and computed by using MATLAB

Léopold Sédar Senghor, who got Diop arrested and thrown in jail where he nearly died. The party was shortly thereafter banned for opposing Senghor's machinations to consolidate his power.

Conclusion

The data gleaned from Diop's *Precolonial Black Africa* made it possible to explore fractal patterns embedded in two dimensions: (1) 'order' and (2) 'disorder'. The substantive findings, as stated earlier, reveal that Diop's text moves halfway across the spectrum – it typically moves from periodic fractal, rather than stretching all the way to pure disorder. It can therefore be suggested that the combination of negative and positive feedback loops, which form the basis of several African knowledge systems – as Ron Eglash (1999:173-4) suggests, also form a key mechanism of general self-organizing systems discussed in *Preco-lonial Black Africa*. In essence, Diop's framing of his characters' experiences is reminiscent of African ways; despite the challenges and hardship, their thought processes never became completely chaotic.

Indeed, as Kofi Nyidevu Awoonor (1990) and I (Bangura 2002) posit, the African life concept is holistic – i.e. it is based on an integrative world view. All life to the African is total; all human activities are closely interrelated. This has as its underlying principle the sanctity of the person, her/his spirituality and essen-

tiality. This essentialist view of the person confers value to her/his personhood. All else – her/his labor and achievements – flow from this value system. Even personal shortcomings cannot invalidate it.

In addition, Awoonor (1990) and I (Bangura, 2002) point out that for Africans, politics defines duties and responsibilities alongside obligations and rights. All these relate to the various activities that have to do with survival. The survival concept is continuing, dynamic and dialectical. The fundamental principle that is at the basis of this conception is a moral one. Moreover, the African moral order never defined rigid frontiers of good and evil. Good and evil exist in the same continuum. Whatever is good, by the very nature of its goodness, harbors a grain of evil. This is a guarantee against any exaggerated sense of moral superiority which goodness by itself may entail. The notion of perfection, therefore, is alien to African thought. Perfection in itself constitutes a temptation to danger, an invitation to arrogance and self-glorification. The principle of balance defines the relationship between good and evil. As life operates in a dialectics of struggle, so also does good balance evil and *vice versa*.

Thus, the essence of an African-centered approach is that it is imperative and urgent for Africans to be concerned about broader development as well as approaches to development that are undergirded by humanity or fellow feeling

toward others. When African-centeredness is considered along with the idea of the socialization effects of develop-mental environments and the possibilities of a reinforcement of these notions and contexts, the implications for an African development process appear vital.

Although compassion, warmth, understanding, caring, sharing, humanness, etc. are underscored by all the major world orientations, African-centered thought serves as a distinctly African rationale for these ways of relating to others. African-centeredness gives a distinctly African meaning to, and a reason or motivation for, a positive attitude towards the other. In light of the calls for an African Renaissance, African-centeredness urges Africans to be true to their promotion of good gover-nance, democracy, peaceful relations and conflict resolution, educational and other developmental aspirations.

We ought never to falsify the cultural reality (life, art, literature) which is the goal of African-centeredness. Thus, we would have to oppose all sorts of simplified or suppo-sedly simplified approaches and stress, instead, the methods which will achieve the best possible access to real life, language and philosophy.

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The Feasibility of the Democratic Developmental State in the South

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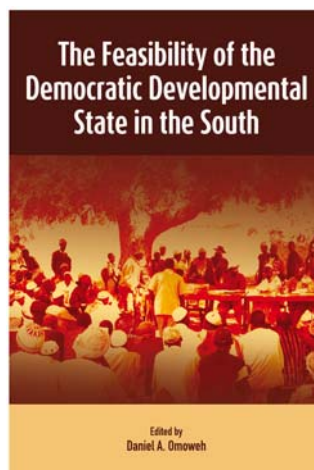
The book examines the prospects of a democratic developmental state in Latin American, African and Asian countries, collectively referred to in this work as the global South. Practically, the state refers to the political leadership. Within this context, it interrogates the politics of the state and the unresolved critical issues it has engendered in the state-development discourse such as the need to re-conceptualize the developmental state, democratization, elections, inclusion, indigenous entrepreneurial and business class, political parties and cooperation among the countries of the South. It looks into the need to re-centre the sought state in the development process of the Southern countries after over two and a half decades of embracing neo-liberal policies and economic reforms that, rather than transform, sank the adjusted economies into deeper political, social and economic crises. It contends that the capacity of the state to overcome the market and democratic deficits resides with its democratic credentials. Finally, it suggests strategies that could lead to the rise of a democratic developmental state in the South.