ANTI-COLONIAL EDUCATIONAL PERSPECTIVES FOR TRANSFORMATIVE CHANGE

African Indigenous Knowledge and the Sciences

Journeys into the Past and Present

Gloria Emeagwali and Edward Shizha (Eds.)

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African Indigenous Knowledge and the Sciences

ANTI-COLONIAL EDUCATIONAL PERSPECTIVES FOR TRANSFORMATIVE CHANGE

Volume 4

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Scope

Informed by an anti-colonial spirit of resistance to injustices, this book series examines the ways and the degree to which the legacy of colonialism continues to influence the content of school curriculum, shape teachers' teaching practices, and impact the outcome of the academic success of students, including students of color. Further, books published in this series illuminate the manner in which the legacy of colonialism remains one of the root causes of educational and socio-economic inequalities. This series also analyzes the ways and the extent to which such legacy has been responsible for many forms of classism that are race- and language-based. By so doing, this series illuminates the manner in which race intersects with class and language affecting the psychological, educational, cultural, and socio-economic conditions of historically and racially disenfranchised communities. All in all, this series highlights the ways and the degree to which the legacy of colonialism along with race-, language-, class- and gender-based discrimination continue to affect the existence of people, particularly people of color.

African Indigenous Knowledge and the Sciences

Journeys into the Past and Present

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EDWARD SHIZHA AND GLORIA EMEAGWALI

INTRODUCTION

The aim of this text is not only to disseminate a historical background of African indigenous sciences, but also to dislocate and disrupt the notion that African indigenous knowledge is confined exclusively to the supernatural. What counts most is not simply discovering the origin of Africa's various forms of science, but unearthing the characteristics of what may rightly be called African science to compensate for centuries of marginalization and devaluation. The goal is also to understand the social and economic implications of impressive cultural innovations. Often, when discussing science in the context of Africa, an exclusively diffusionist hypothesis is projected in most literature with the tendency to perceive Africa as a passive recipient of foreign science without its own unique contributions. There is often a reluctance to consider or acknowledge that diffusionist hypotheses may well be irrelevant, questionable and false; paradoxically, most of the diffusionist theses proposed centuries ago by colonial anthropologists and pseudo historians, have never been in any way confirmed. Furthermore, there is, perhaps, cultural or political resistance to accepting the evidence that Africa has evolved its own explanatory framework and system of ideas as portrayed in the content and context of its indigenous knowledge systems.

Diffusionist theses have been fabricated to a wide range of fields, including iron production. The same can be said of several other endogenous achievements within Africa. However, within the last ten years much research on metallurgy and other technologies has been documented, in Africa and elsewhere in the world, and many diffusionist theories have crumbled under the weight of the evidence (Hughes, 2012). The publications that have emerged to rupture the diffusionism theory clearly attest to advanced indigenous expertise in African metallurgy and related technologies in general (Bocoum, 2004).

Explanations of worldly phenomena come and go, but acceptance of any explanation claiming to be "scientific" is constrained by the widespread belief that it should fit smoothly into the worldview prevailing in science at the time it is proposed (Callahan & Leeson, 2006, p. 2). However, the assumption of "a worldview prevailing in science at the time" is misleading as it connotes that there is one worldview that proffers scientific explanations. While we agree that science is not static, we disavow the notion that science has its explanations from a particular regional and eurocentric worldview. Definitions of any concept depend on the cultural worldview of the people who use the concept for their everyday practices. Any form

of science is dependent on cultural practices (whether indigenous or western) and relies on direct observation, experience, experimentation, and interpretation.

Discounting and underrating scientific epistemologies and ontologies that are associated with indigenous societies has been a major tendency by Eurocentric observers. Building technologies, physics and mathematical principles used in constructing indigenous structures such as Great Zimbabwe are dismissed as non-scientific. In addition, ethno-medicinal treatment of illness and diseases as well as the application of spiritual healing from holistic geoscience and human interactions are viewed with suspicion. Rather than working within carefully constructed boundaries and methodologies established by cultural theories, they broadly generalize entire fields of academic expertise and dismiss many of them. Eurocentric scientism reduces science to a monolithic interpretation of the social reality using reductionist views, thus, restricting human inquiry.

African indigenous knowledge fulfills the expectations about science; although Africans do not consider themselves as "masters and possessors of nature," but respect nature as a resource that comes with sustainability considerations attached to it. Whether it is physics, geoscience or medicinal knowledge, African indigenous knowledge has existed for centuries and generations and has been sustainably utilized to serve African communities and societies. Indigenous knowledge has gained attention and acknowledgement as another form of science that can be used to explain phenomena and socio-cultural realities of diverse African societies. The authors in this book have taken the indigenous Africanist perspective to illustrate how indigenous knowledge reveals itself as a science. In the seventeen chapters that make up this text, authors point out, through historical narratives and illustrative data, that science in its different forms existed in African societies.

We shall now focus on some of the issues highlighted by the various contributing authors of this text, which is divided into five segments. In his discussion of pedagogical principles in technology teaching, Mishack Gumbo reminds us of the disservice to students from diverse cultural background of teaching strategies that fail to recognize the diversity of students. Place-based pedagogies synonymous with African indigenous ways of knowing and learning, which are relevant to the background, learning styles and student centered priorities of students, are necessary to make up for this pedagogical deficiency. His argument and point are endorsed by Yovita Gwekwerere who independently focuses on the Eurocentric bias of science education in Africa and seeks to narrow the gap between the teaching of physics, the curriculum and the experiences of children. Students should be given contextualized local examples with meaningful examples and illustrations from their cultural background, argues Gwekwerere, and she proceeds to give specific alternative models applying indigenous perspectives for achieving this end. Edward Shizha concludes the segment on epistemological and pedagogical issues with a focus on the diversity within Africa. He provides more examples of the appropriate technology that emerged from within Africa and expands on some of the issues discussed in this opening chapter.

Our intellectual journey then shifts to African perspectives on time through the scholarly discourse of Vongai Mpofu; Francis Muchenje, Ruth Gora and Ngoni Makuvaza; and Mathias Sithole, in three separate chapters. How do Africans perceive time? What distinguishes the rectilinear models of time from some of those that evolved within Africa? How do worldviews such as *Unhu*/*Ubuntu* intersect with African concepts of time? What about African management of periods of leisure and rest within a specific time frame? How do ideas about materials, circular motion, levers, centers of gravity, buoyancy, tension, friction, resonance, sound waves, energy and force manifest themselves in the African context. How best can we convey these principles to students of physics? These are some of the issues of concern to these authors. The segment on physics and cosmology concludes with discourses by Atah Pine on Tiv divination and Peter Alcock on South African indigenous knowledge about the stars.

We then move on to a slightly different area of discourse with a focus on West African enclosures and structures of various kinds by David A. Aremu, Aribidesi Usman and Patrick Darling in independent chapters. Gloria Emeagwali, looking at African traditional medicine, discusses some of the phytochemical reports that underlie many of the herbal resources frequently prescribed by medical practitioners. This segment on medicine and health is enriched by illuminating discussions on ethnomusicology and healing by Charles Aluede and Vincent Aiwuyo, and concludes with Evadne Ngazimbi's insightful chapter on indigenous narrative therapy. *African Indigenous Knowledge and the Sciences: Journeys into the Past and Present* concludes with a focus on metallurgy by two veteran archeologists, Jay Spaulding and Richard Darling who discuss ironmaking in East and West Africa, respectively.

We invite readers to embark on a stimulating intellectual journey with us as we illuminate the various dimensions of African indigenous knowledge systems and the sciences.

REFERENCES

Bocoum, H. (2004). Introduction. In H. Bocoum (Ed.), *The origins of iron metallurgy in Africa: New light on its antiquity, West and Central Africa* (pp. 21–30). Paris: UNESCO Publishing.

Callahan, G., & Leeson, P. T. (2006). *Scientism in the way of science: Hope for heterodoxy in modern economics*. New York, NY: Mimeo.

Hughes, A. L. (2012). The folly of scientism. *The New Atlantis: A Journal of Technology & Society*, 32–50. Retrieved December 30, 2015, from www.thenewatlantis.com/docLib/20121116_TNA37Hughes.pdf

PART 1

EPISTEMOLOGICAL AND PEDAGOGICAL ISSUES

GLORIA EMEAGWALI AND EDWARD SHIZHA

1. INTERCONNECTING HISTORY, AFRICAN INDIGENOUS KNOWLEDGE SYSTEMS AND SCIENCE

In this chapter we discuss the genesis of science in Africa with reference, first of all, to the South African Cape region, about one hundred thousand years ago (Jacobs, Duller, Henshilwood & Wintle, 2006). We then reflect on aspects of science as it evolved in ancient northeast Africa with some reference to ancient Nubia, Ethiopia and Egypt, highlighting aspects of the contributions made in ceramics, building technology, medicine and metallurgy. Brief references are also made to Southern Africa, in this case the Kingdom of Mapungubwe, precursor to Great Zimbabwe (Duffey, 2012). We reflect on some of the conceptual underpinnings of African Indigenous Knowledge (AIK) as science, and conclude with specific reference to the individual authors/chapters of this text and their contributions to this discourse on AIK and the sciences.

As pointed out in an earlier work (Emeagwali & Dei, 2014), evidence found at Wonderwerk Cave in 2012, in South Africa, point to the earliest use of fire-making in the world, going back a million years. Berna et al. (2012) discuss the dating of evidence from the site such as burnt bone and the ashes from plant remains. The scientific world also discovered, with amazement, that ancient Africans developed the capacity to mix paint in containers in the form of abalone shells, and coat their ornaments with iron oxide pigment as early as 100,000 years ago, thus creating a world record, yet to be superseded in the annals of ancient science and technology. Assumptions and conjectures were made and so, too, long-term projections, in the assemblage of hammer-stones, grindstones, ochre, animal fat, iron oxide powder, and charcoal, to make the paint in the mini containers. These discoveries of Henshilwood (2007) and Henshilwood et al. (2001, 2011) have not only cast new light on the African genesis of chemistry but they have also confirmed the fact that Africa was indeed a birthplace of science as we know it, and that indigenous knowledge capabilities to cope with the environment and create value have a long history in the continent. We also know that as early as one hundred thousand years ago, there were the beginnings of written symbolic language in the form of triangles and horizontal lines, also in ancient South Africa, based on the geometrical engravings that have been found. The discoveries of Blombos in the South African Cape, point to the earliest evolution of abstract design, creativity and symbolism in the world and marks some of the earliest documentation of African Indigenous Knowledge to date

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(Henshilwood et al., 2001; Tribolo et al., 2006). What is clear from these discoveries is that the knowledge evolving within the continent from this early period was aimed at problem solving, and involved specific trial and error experimentation and goals.

By 9000 BC, some of the earliest ceramics emerged in Nubia, predating those of ancient Egypt and Ethiopia, which may have lagged behind in this sphere, relatively speaking (Ehret, 2002), granted that Malian pots, dated 11,400 years ago, are older (Huysecom et al., 2009). By the Aksumite era of Ethiopian history, however, we have a wide range of ceramic products in the form of shallow thin-walled bowls, deep bowls with rims, basins, pots, jars, jugs, storage pots, braziers, legged vessels, beakers, semi-globular round-bottomed bowls, cooking pots, pedestal vessels and bird-shaped vessels, the product of indigenous innovation and skill (Phillipson, 2000, p. 303). Fast-forward to the early and late Aksumite era, between 1000 BCE and 1000 AD, and we have close to two hundred stelae obelisks, one of the largest being 33 metres (110 ft.) weighing 750 tons and representing a building, thirteen storeys high, the largest single block of stone ever quarried, sculptured and erected in the ancient world (Connah, 2001). Likewise, archeologists have found in this region, evidence of numerous multi-storied residences, elite houses and mansions, some of which may have been palaces. One of the present authors had the opportunity to view one of these elite structures dated about 1000 BC in Yeha, about two hundred kilometers from the town of Axum, where the former occupant of the building bitterly criticized the modus operandi of the German archeologists in charge of the excavation, complaining about the inadequate compensation given for the legacy of her ancestors that was reluctantly sold to the team conducting the excavation. The structure in question had more than twenty rooms and yielded pots dating back to about twenty seven hundred years. Other ancient structures in present day Aksum, Gondar and Lalibela include:

- Dams and Rainwater Cisterns
- Terraces
- Several subterranean multi-chambered tombs for the elite
- Complexes of courtyards and towers
- Stone castles, the nucleus of the court and capitals
- Stone altars
- Murals, many of which are in monasteries and ancient temples, painted with local pigment that seems to outlast synthetic paint.
- Sculptured churches and temples, sculpted between the 5th and 16th century in the highlands and Tigre Province. About forty-four temples at Gondar and a totality of more than 300 temples at Matara, Haoulti and Mantara. We may estimate about five hundred of these structures, bearing in mind that the discovery of ancient Ethiopian structures is an ongoing process.

We shall now make a few comments on ancient Egypt, whose mastery of medicine is celebrated in a variety of scrolls, named, unfortunately, after adventurers, merchants and others, rather than the ancient Egyptians themselves. In the so-called

Edwin Smith papyri, are careful discussions of injuries to the top of the head; injuries to the face; injuries to the jaw, neck, thorax, spine and arm; the names of human body parts and anatomy; neurological symptoms; the earliest known description of the brain; the first description of the meninges and brain pulsations; and a clear familiarity with the nervous system, blood circulation and the cardio-vascular system. But even so, Egyptian medicine was holistic and reflected a preoccupation with the supernatural, the divine and ancestral forces, in a manner that is quite familiar to scholars of African Indigenous Knowledge Systems. Invocations and prayers accompanied medication and were believed to be vital and indispensable for the medication to work effectively (Finch, 1998; Nunn, 1997; Sauneron, 2000).

Before the disruption of African technological advancement by slavery and colonialism, Africa witnessed the *in situ* genesis of an ironmaking industry that contributed to the technological heritage of humanity. The metallurgic know-how was a broad spectrum of expertise and included the making of steel in ancient Tanzania, as discussed in great detail by Schmidt (1997, p. 127):

> The Haya smelt had many distinctive features, including the preheating of the blast air, the efficient recovery of iron, the carbon boil, the formation of cast iron, and the formation of phosphorus rich cast iron. It is simply easier to believe that these many interlocking features arose from an incremental process of experimentation than to believe that they were learned as an ensemble by imitation. Moreover, reflecting on these innovations, one comes to realize that they are all, one way or another, adaptations to the chemistry peculiar to local materials: the limonite ores, the Mucwezi charcoal, the swamp reeds and the refractory tuyere clay.

Such technologies were also confirmed by Okafor (2004) in regard to the size and use of furnaces and the treatment and production of fuel, and de Maret (2004), who writes not only of technical diversity, but also of the importance of the cultural and symbolic diversity of African iron metallurgy. We should also note that in the case of ancient Nubia, in northeast Africa; Ghana, Mali and Songhay in West Africa; and Mapungubwe and Great Zimbabwe in Southern Africa, effective gold mining technologies emerged over time. Not only was ancient Nubia a major source of gold for Egypt, but it was also a major innovator and designer of jewelry. Markowitz and Doxey point out that "nothing exceeds Nubian jewelry and other items of personal adornment in terms of technical mastery, elegance of design, innovation and sheer beauty" (2014, p. 9). Nubian material artifacts speak a million words and are even more important than written documents, in our understanding of ancient technological wizardry. We stare in wonder at the delicately fashioned gold rosettes; hinged collars made of gold and silver; gold pectorals of Auset (Isis); the golden mask of Queen Malakaye of the Napata era; and numerous necklaces, ear studs, earrings, fly pendants, arm bands of gold and gilded beads. Some date as early as 2500 BC and the Nubian kingdom of Kerma. They reflect precision and detailed asymmetrical measurement, the product of standardized equipment and the weights

and measures of precision found in excavations and "diamond shapes stamped from gold sheets" were applied to flat surfaces and wires hammered from thin pieces of gold (Markowitz & Doxey, 2004, p. 89).

As we shift to Southern Africa's Kingdom of Mapungubwe, variations of this technique appear in a wide range of exquisite gold objects, including the famous Golden Rhino, golden scepters, gold foil fragments with chevron patterns, gold beads and nails, necklaces, armlets, bangles and bracelets of all shapes and dimensions. As pointed out by Duffey, Tiley-Nel, de Kamper and Ernst (2008), many of Mapungubwe's objects are "rare and unique in the world" (p. 26), yet they continue to be Southern Africa's best well-kept secret, totally ignored in numerous textbooks, and relatively unknown by the very descendants of these sophisticated metallurgists. Unfortunately, post-apartheid South African authorities continue to keep some of their most cherished historical artifacts within remote game parks, inaccessible to many of its citizens and frequented mostly by head hunting tourists in search of animal trophies.

It is apparent that had the past indigenous sciences and technologies not been disrupted, they could have helped Africa to compete in the present technological advancement. In line with this argument, the dominance of western, Eurocentric scientism is challenged by Hutchinson (2011) who offers an insightful metaphor for the current controversies over science:

> The health of science is in fact jeopardized by scientism, not promoted by it. At the very least, scientism provokes a defensive, immunological, aggressive response from other intellectual communities, in return for its own arrogance and intellectual bullyism. It taints science itself by association. (p. 143)

The bullish dominance of western science had a negative and destructive effect on the development of other technologies by undervaluing the creativity of other cultures and societies.

Scientific knowledge, in whatever form, definition and cultural context it may exist, is found in all societies. Each society has its own way of categorizing and labelling types of knowledge. However in African indigenous communities, knowledge is often treated as a holistic body of knowledge. African indigenous knowledge systems, which are based on the natural environment and human practices for human sustainable development, are intricately interrelated. As noted by Adyanga (2014), these science practices are generational and synergistic with other disciplines such as history, geography, trade and commerce. African indigenous science is embedded within the larger body of knowledge constructs that constitute African indigenous knowledge systems. While most research and publications have focused on social science theories and paradigms (Emeagwali & Dei, 2014), less has been written with regards to the so-called 'natural sciences'. This book seeks to fill the gap and address some of the misconceptions about the African indigenous knowledge. Of particular interest in this book is how physics, geoscience and other sciences were developed and utilized in African societies.

African civilization and societies are replete with cultural knowledge that is deeply rooted in local cultures and everyday lived experiences. African indigenous societies have, for centuries, developed their own sets of lived experiences and explanations relating to the environments they live in (Kimwaga, 2010). Our argument in this book is that indigenous sciences have always existed in African societies. This is due to the fact that the way knowledge is produced and utilized and how people actually learn it and transmit it is culturally specific. Different cultures have different ways of experiencing social reality and, hence, different ways of categorizing knowledge (Shizha, 2015). This is influenced by their worldview and belief systems as well as perceptions about the natural environment, including the socio-economic and ecological context of their livelihoods (Shizha, 2014). In fact, the history of Africa's indigenous ways of knowing and knowledge production did not begin with the coming of Western knowledge systems, and neither should their future depend exclusively on Western and other worldviews (Kaya, 2014). Unfortunately, rather than western science acknowledging the multiple, collaborative and accumulative dimensions of knowledge, western scholars and scientists attempted to either dismiss, devalue or negate indigenous knowledge as being not worthy of scholarly engagement (Emeagwali & Dei, 2014; Shizha, 2015). In the same vein, there are also African scholars who have been 'miseducated' in western paradigms and perspectives of what is perceived as scientific knowledge who tend to mythicize and devalue indigenous science. Many African scholars went through a western education system that indoctrinated them to view African indigenous knowledge and its scientific epistemologies and ontologies as irrelevant to 'modernization', and hence invalidated and irrelevant. However, as various authors reveal in this book, African scientific knowledge has a role to play in human development as it is widely practised in African communities and used to solve problems that affect communities and their members as they encounter challenges from their ecosystems and cosmic environment.

While science, from a western, theoretical and methodological perspective, is judged from a positivist approach, indigenous science is defined from its holistic and utility perspective. Indigenous science is better understood as practical, personal and contextual units which cannot be detached from an individual, their community or the environment (both physical and spiritual). African knowledge, and its method of acquisition, has a practical, collective and social or interpersonal slant (Owusu-Ansah, 2013). Before the advent of Western methods of scientific inquiry, African knowledge and methods had successfully guided people in all spheres of life, including the spiritual, social, educational, agricultural, political and economic (Tanyanyiwa & Chikwanha, 2011). Knowledge of science empowers members of society with the abilities and capabilities to deploy and employ practical techniques and skills to manage their natural environment and to find ways to solve human problems. This is the central theme is this book. Different authors have examined different ways in which African indigenous sciences were utilized by African people to advance knowledge and to develop skills and abilities to make sense of their natural

world and to improve their livelihoods. Indigenous African science encompasses a sophisticated array of information, understanding and interpretation that guides interactions with the natural milieu: in agriculture and animal husbandry, hunting, fishing, natural resource management, conflict transformation, health, the naming and explanation of natural phenomena, and strategies to cope with fluctuating environments (Semali & Kincheloe, 1999; Kante, 2004; Horsthemke, 2004).

Indigenous knowledge systems constitute the core of community-development processes in agriculture, the preservation of food, collection and storage of water, animal husbandry and ethnic veterinary medicine. It also forms the basis of indigenous interpretation of meteorological and climatic phenomena, orientation and navigation on land and sea, as well as in the management of natural resources. Indigenous knowledge is also very useful in local primary health care, preventive medicine and psychosocial care as well as the role of procreation (Abah, Mashebe, & Denuga, 2015). Indigenous people possess an immense knowledge of their environments, based on centuries of living close to nature. By living in and from complex ecosystems, they have an understanding of the properties of plants and animals, the functioning of ecosystems and the techniques for using and managing them, a system that is particular and often detailed and transmitted to the younger generation through traditional songs, stories, narratives, epics, legends, dreams and practices (Abah et al., 2015; Chikaire et al., 2012).

Technical knowledge or science is always adaptable and malleable. It is knowledge that evolves and adapts to the changing circumstances in which members of the communities find themselves. In fact, indigenous knowledge has not remained static, neither has it been confined to the shores of the African continent. Like all knowledge systems, such knowledges have diffused and interacted with other ways of knowing from other communities (Emeagwali & Dei, 2014). Its adaptability enables local African communities to better understand the differences and interactions between their science and other knowledge systems in order to reconstruct their own knowledge systems and to make better-informed decisions about which knowledge (internal or external) is appropriate for their sustainable future (Seleti, 2010). It is heartwarming that development practitioners are starting to realize the importance of recognizing and working with indigenous knowledge sciences, which builds on generations of experience, to best support the adaptive capacity and strategies of rural communities. There is increasing acknowledgement that indigenous forecasting methods are locally relevant and needs-driven, focus on the locality and timing of rains, and are communicated in local languages and by local experts known and trusted by the people themselves (Kaya, 2014; Chikaire et al., 2012).

Science and its methods of investigation and ways of interpreting social and natural realities cannot be divorced from a people's history, cultural context and worldview. Worldview shapes consciousness and forms the theoretical framework within which knowledge is sought, critiqued and or understood (Sarpong, 2002 cited in Owusu-Ansah & Mji, 2013). Almost all knowledge has cultural relevance and must be examined for its particular focus without universalizing it in the manner that

western scientific thought and methodologies seek to do. According to Asante (1987, p. 168), the hallowed concepts and methods within western thought are inadequate to explain all of the ways of knowing because "universality can only be dreamed about when we have 'slept' on truth based on specific cultural experiences." While we should be careful not to universalize western science as *the* relevant and valid knowledge, we should also be careful not to universalize African indigenous science as homogenous and universal to all African societies. Indigenous African science is unique to each African society, although there may be commonalities within these bodies of knowledge. We should acknowledge that even in African societies themselves, there are different forms of scientific knowledge since each society may have its own way of viewing social reality, and its own way of interacting with the natural world. African indigenous science is place-oriented and often orally transmitted partly because it is people-centered. Indigenous science is primarily concerned with the utility, accessibility and practicability of knowledge.

REFERENCES

Abah, J., Mashebe, P., & Denuga, D. D. (2015). Prospect of integrating African indigenous knowledge systems into the teaching of sciences in Africa. *American Journal of Educational Research*, *3*(6), 668–673.

Adyanga, F. A. (2014). *African indigenous science in higher education in Uganda*. A thesis submitted in conformity with the requirements for the degree of Doctor of Philosophy, Graduate Department of Humanities, Social Sciences and Social Justice Education, Ontario Institute for Studies in Education, University of Toronto.

Allen, J. (2005). *The art of medicine in Ancient Egypt*. New York, NY: Metropolitan Museum of Art.

Asante, M. K. (1987). *The Afrocentric idea*. Philadelphia, PA: Temple University Press.

Berna, F., Goldberg, P., Horwitz, L. K., Brink, J., Holt, S., Bamford, M., & Chazan, M. (2012, May 15). Microstratigraphic evidence of in situ fire in the Acheulean strata of Wonderwerk Cave, Northern Cape province, South Africa. *Proceedings of the National Academy of Science*, *USA*, *109*(20), E1215–E1220.

Bocoum, H. (2004). Introduction. In H. Bocoum (Ed.), *The origins of iron metallurgy in Africa: New light on its antiquity, West and Central Africa* (pp. 21–30). Paris: UNESCO Publishing.

Callahan, G., & Leeson, P. T. (2006). *Scientism in the way of science: Hope for heterodoxy in modern economics*. New York, NY: Mimeo.

Chikaire, J., Osuagwu, C. O., Ihenacho, R. A., Oguegbuchulam, M. N., Ejiogu-Okereke, N., & Obi, K. U. (2012). Indigenous knowledge system: The need for reform and the way forward. *Global Advanced Research Journal of Agricultural Science*, *1*(8), 201–209.

Connah, G. (2001). *African civilizations – An archaeological perspective*. Cambridge: Cambridge University Press.

de Maret, P. (2004). Central Africa: Knowing iron. In H. Bocoum (Ed.), *The origins of iron metallurgy in Africa: New light on its antiquity, West and Central Africa* (pp. 127–134). Paris: UNESCO Publishing.

Duffey, A. (2012). Mapungubwe: Interpretation of the gold content of the original gold burial M1, A620. *Journal of African Archaeology, 10*(2), 175–187.

Duffey, A., Tiley-Nel, S., de Kamper, G., & Ernst, J. (2008). *The art and heritage collections of the University of Pretoria*. Pretoria, South Africa: University of Pretoria.

Ehret, C. (2002). *The civilizations of Africa: A history to 1800*. Charlotteville, VA: University Press of Virginia.

Emeagwali, G., & Dei, G. J. S. (Eds.). (2014). *African indigenous knowledge and the disciplines.* Rotterdam, The Netherlands: Sense Publishers.

Finch, C. (1998). *The star of deep beginnings: The genesis of African science and technology*. Decatur, Georgia, GA: Khenti Press.

Henshilwood, C. S. (2007). Fully symbolic *sapiens* behaviour: Innovation in the Middle Stone Age at Blombos Cave, South Africa. In. C. Stringer & P. Mellars (Eds.), *Rethinking the human revolution: New behavioural and biological perspectives on the origins and dispersal of modern humans* (pp. 123–132). MacDonald Institute Research Monograph series, Cambridge: University of Cambridge Press.

Henshilwood, C. S., d'Errico, F., van Niekerk, K. L., Conquinot, Y., Jacobs, Z., Lauritzen, S.-E., … García-Moreno, R. (2011). A 100,000-year-old Ochre-processing workshop at Blombos Cave, South Africa. *Science*, *334*(6053), 219–222.

Henshilwood, C. S., D'Errico, F., Marean, C. W., Milo, R. G., & Yates, R. (2001). An early bone tool industry from the Middle Stone Age at Blombos Cave, South Africa: Implications for the origins of modern human behaviour, symbolism, and language. *Journal of Human Evolution*, *41*, 631–678.

Henshilwood, C. S., Sealy, J. C., Yates, R., Cruz-Uribe, K., Goldberg, P., Grine, F. E., … Watts, I. (2001). Blombos cave, Southern Cape, South Africa: Preliminary report on the 1992–1999 excavations of the Middle Stone Age levels. *Journal of Archaeological Science, 28*(4), 421–448.

Horsthemke, K. (2004). 'Indigenous knowledge' – Conceptions and misconceptions. *Journal of Education, 32*, 1–15.

Hughes, A. L. (2012). The folly of scientism. *The New Atlantis: A Journal of Technology & Society*, 32–50. Retrieved December 30, 2015, from www.thenewatlantis.com/docLib/20121116_TNA37Hughes.pdf

Hutchinson, I. (2011). *Monopolizing knowledge: A scientist refutes religion-denying, reason-destroying scientism*. Belmont, MA: Fias Publishing.

Huysecom, E., Rasse, M., Lespez, L., Neumann, K., Fahmy, A., Ballouche, A., … Soriano, S. (2009). The emergence of pottery in Africa during the 10th millenium cal BC: New evidence from Ounjougou (Mali). *Antiquity*, *83*, 905–917.

Jacobs, Z., Duller, G. A. T., Henshilwood, C. S., & Wintle, A. G. (2006). Extending the chronology of deposits at Blombos Cave, South Africa, using optical dating of single and multiple grains of quartz. *Journal of Human Evolution*, *51*, 255–273.

Kante, P. (2004). Indigenous knowledge and environmental concerns in Africa. *Economic and Political Weekly, 4*(22), 31–44.

Kaya, H. O. (2014). Revitalizing African indigenous ways of knowing and knowledge production. *E-International Relations: Open access website for students and scholars of international politics*. Retrieved December 29, 2015, from www.e-ir.info/2014/05/26/ revitalizing-african-indigenous-ways-of-knowing-and-knowledge-production/

Kimwaga, S. (2010). *African indigenous psychology and Eurocentricism*. Unpublished Manuscript, College of Business Education, Dar es Salaam, Tanzania.

Markowitz, Y., & Doxey, D. (2014). *Jewels of Ancient Nubia*. Boston, MA: Museum of Fine Arts.

Nunn, J. (1996). *Ancient Egyptian medicine*. Norman, OK: University of Oklahoma Press.

Okafor, E. E. (2004). Twenty-five centuries of Bloomery iron smelting in Nigeria. In H. Bocoum (Ed.), *The origins of iron metallurgy in Africa: New light on its antiquity, West and Central Africa* (pp. 43–54). Paris: UNESCO Publishing.

Owusu-Ansah, F. E., & Mji, G. (2013). African indigenous knowledge and research. *African Journal of Disability*, *2*(1), Art. #30, 1–5.

Phillipson, D. (2000). *Archaeology at Aksum, Ethiopia, 1993–7* (Vol. 1). London: British Institute in East Africa (B.I.E.A.).

Sauneron, S. (2000). *The priests of Ancient Egypt*. Ithaca, NY: Cornell University Press.

Schmidt, P. (1997). *Iron technology in East Africa*. Bloomington, IN: Indiana University Press.

Seleti, Y. N. (2010, February). *Interfacing indigenous knowledge with other knowledge systems in the knowledge economy: The South African case*. Library Symposium 2010: Presidential Meeting. Knowing is not enough: Engaging in the knowledge economy, Stellenbosch University South Africa.

Semali, L. M., & Kincheloe, J. L. (1999). Introduction: What is indigenous knowledge and why should we study it? In L. M. Semali & J. L. Kincheloe (Eds.), *What is indigenous knowledge? Voices from the academy*. New York, NY & London: Falmer Press.

Shizha, E. (2014). Indigenous knowledge systems and the curriculum. In G. Emeagwali & G. J. S. Dei (Eds.), *African indigenous knowledge and the disciplines* (pp. 113–128). Rotterdam, The Netherlands: Sense Publishers.

Shizha, E. (2015). Reclaiming indigenous cultures in African education. In W. J. Jacobs, S. Y. Cheng, & M. K. Porter (Eds.), *Indigenous education: Language, culture, and identity* (pp. 301–317). New York, NY: Springer.

Tanyanyiwa, V. I., & Chikwanha, M. (2011). The role of indigenous knowledge systems in the management of forest resources in Mugabe area, Masvingo, Zimbabwe. *Journal of Sustainable Development in Africa*, *13*(3), 132–149.

Tribolo, C., Mercier, N., Selo, M., Joron, J-L., Reyss, J-L., Henshilwood, C. S., … Yates, R. (2006). TL dating of burnt lithics from Blombos Cave (South Africa): Further evidence for the antiquity of modern human behaviour. *Archaeometry*, *48*(2), 341–357.

MISHACK T. GUMBO

2. PEDAGOGICAL PRINCIPLES IN TECHNOLOGY EDUCATION

An Indigenous Perspective

INTRODUCTION

In this chapter, the author proposes principles that should be considered when teaching technology in indigenous contexts. The chapter is not about educational technology, computer integrated teaching or information and communication technology. The chapter is about *Technology Education,* which is a school subject taught to students. Around the world, many teachers teach in indigenous or multicultural contexts, yet they are poorly prepared to do so. They simply turn a blind eye to integrating pedagogical perspectives that recognize indigenous learners during their teaching. Passive learning seems to be a predominant outcome (Lavonen, Autio & Meisalo, 2004) because students are turned off by the pedagogical strategies that do not consider students' diverse cultures. This problem is compounded by curricula devoid of content from indigenous places, as well as teaching and learning materials that neglect such content. There is a great need to utilize the wealth of local indigenous knowledge systems and to incorporate them into mainstream formal education (Msila, 2007).

Literature abounds with accounts of the marginalization of indigenous learners or diasporans when it comes to the teaching of technology (Apple, 1986; Eggleston, 1996; Zuga, 1997; O'Riley, 2001). The universalist and industrial approaches (Fleer, 2015) monopolize the content and pedagogy of technology education. But inclusive pedagogy concerning indigenous students is an under-researched phenomenon. In this chapter are suggested principles that could transform the teaching of technology to the benefit of indigenous students. These principles are sourced from the literature and they are anchored on collectiveness, holism, co-creative orientation, cooperative approach to problem solving, experiential knowledge, orality, ubuntu, spirituality, values and complexity (Gumbo, 2014; Ngara, 2007; Masango, 2006; Emeagwali, 2003), these principles relate very closely to the life principles of indigenous communities.

In order to arrive at these principles, there is a need to define technology and technology education, curriculum and pedagogy, and argue that technology teaching needs to change, as well as to briefly discuss frameworks that support the suggested principles. The approach in the chapter is explorative and is not focused on one country only.

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DEFINITIONS OF TECHNOLOGY AND TECHNOLOGY EDUCATION

Technology

Technology is about engaging complex processes that involve knowledge, skills and resources available in various environmental contexts, to produce solutions to societal problems or to meet needs and/or wants. The Department of National Education in South Africa, now the Department of Basic Education (DBE), defines Technology as, "the use of knowledge, skills, values and resources to meet people's needs and wants by developing practical solutions to problems, taking social and environmental factors into consideration" (2011, p. 8). According to *Indiana Technology Education Curriculum Standards* (2006, p. 3),

> Technology is a body of knowledge and action, used by people, to apply resources in developing, producing, using and assessing products, structures and systems in order to control and modify the natural and human-made (modified) environment.

Through the help of other scholars, Williams (1996) defines technology through its characteristics. According to Williams (1996, p. 3), therefore, technology:

- extends human potential through action;
- addresses human needs and wants;
- is a human creation and is thus implemented and used by people;
- is mostly and practically implemented through the use of tools, machines, techniques, systems and technical ways;
- exists in, affects and is affected by society and culture;
- is evident in every culture irrespective of its level of sophistication or stage of development;
- enables people to exert control over the natural environment;
- is important for the people to survive; and
- is future orientated.

Since this chapter is written from an indigenous knowledge systems angle, it is important to consult literature about the indigenous definitions of technology. According to Senabayake (2006), indigenous knowledge is unique and closely related to a particular culture or society and can thus be referred to as local/traditional knowledge, folk knowledge, people's knowledge, traditional wisdom or traditional science. The fact that indigenous knowledge is mostly evident in practical activities such as agriculture, food preparation and conservation, health care and education (Senanayake, 2006), qualifies it to be referred to as indigenous technology (Battiste, 2002; Robyn, 2002; Kimbell, 2008).

Culture harbours both the material and non-material expressions of a people (Ogungbure, 2011). Alternatively, material and non-material expressions can be termed tangible or intangible devices, formulations and techniques which

fulfil some need or provide some service for humankind in a given environment (Moalosi, Popovic, Kumar, & Hudson, 2005; Obikeze, 2011). These expressions are technologies because they are meant to address people's problems, needs and/or wants. Three categories of these technologies include:

a. Material (physical) technology such as bows and arrows, ploughs, looms, laboratories, machines, electronic devices, knives, fishing nets, explosives, etc. The material side of technology provides its visible and tangible nature. For example, one can see, feel and touch a bow and possibly know its function.
b. Social technology such as methodologies, techniques, organizational and management skills, bookkeeping and accounting procedures, negotiating and counselling techniques and social institutions like patriarchy and matriarchy; songs, jokes, ideas, skills, etc. This dimension of technology accounts for the process nature of technology between the input and output.
c. Communication technology is inclusive of language, signs and symbols, drumming, and the internet, etc. This last dimension of technology markets technology in different forms, for example, a symbol that represents a certain technological device posted on a particular website may arouse interest in those who become aware of it; they may begin to contact the designer or manufacturer.

These cultural products (technologies) are in turn organized in terms of goods and services. Thus, they are further sub-divided into:

i. Material goods such as soap, food items such as maize, ornaments, television sets, houses and aeroplanes, etc. The material goods are mostly a result of the function of the material technologies above. For example, a crushing stone with its base or processing machinery used to process maize into maize-meal.
ii. Social goods/services such as values, norms, customs, motherhood, priesthood and friendship; social goods/services like concerts and plays, football games, health and healing systems and belief systems, etc. From a cultural point of view these social goods shape the technologies in certain cultural settings. For example, the belief system for a particular culture may affect the type of medical technology that can be applied in that cultural setting, and hence, decisions and application of technology in such setting should consider differences of this nature.
iii. Intellectual goods such as ideas, abstract concepts, names, terminologies, cognitive knowledge and idioms, etc. These goods are brought about by how people are informed by their cultural systems. The ideas that I am expressing in this chapter, for example, are informed by my thinking about technology as conceived from an indigenous cultural perspective. Seemann (2000) contends that cognitive activity and cultural milieu are inseparable and that a society educates its young by passing down its socio-cultural attributes that guide what a child learns and becomes.

These categories of technology informed by culture have serious implications about how technology should be taught, especially in indigenous contexts or to

a student group that includes students with indigenous backgrounds. Technology teachers cannot afford to design teaching strategies which do not help them (students) learn meaningfully.

Technology Education

Technology education as a school subject has been referred to as Industrial Arts, Craft and Design, Textiles and Work, Industrial Education and Technology Education (Dugger, 2008, p. 1) in different contexts. In the previous versions of the curriculum in South Africa, it was referred to as Technology Learning Area. In the new Curriculum and Assessment Policy Statement (CAPS) (Department of Basic Education [DBE], 2009) it is referred to as Technology. The dominant international terms by which it is known are Technology Education and Design and Technology Education. I prefer to use the term Technology Education in this chapter. I find it logical to adopt this term because after defining Technology one needs to know what Technology Education is, then.

Technology Education is a subject with its own content and methods, the intention of which is to prepare students to participate in the technological or engineering (job) environments. Technology Education is a unique theory-practice subject that presents opportunities for teachers to engage students in the learning activities that are informed by their (students') thinking, which is in turn shaped by their (students') environments or cultural backgrounds. The design concept—which drives the teaching of the subject (referred to as the backbone of Technology Education) through a problem-solving approach to investigate, design, make, evaluate and communicate, not followed linearly—should allow students room to express their design ideas from their cultural contexts. However, as expressed in the introduction, while teaching technology has always suggested inclusive strategies, research has been almost silent on making the teaching of technology relevant to indigenous contexts. This silence is obviously informed by a western Eurocentric approach to education in general, which perpetrates the exclusion of indigenous knowledge and overemphasizes a "modern" industrial concept of technology to the detriment of indigenous forms of technology.

Pudi (2007, pp. 37–38) discussing technology education in the school science curriculum provides the following definition:

> Technology Education can be seen as a comprehensive experience-based educational programme that allows learners to investigate and experience the means by which people meet their needs and wants, solve problems and extend their capabilities. It is concerned with the knowledge and skills necessary to develop, produce and use products or services, and how to assess the impact of these activities on humanity and the environment (ethical considerations).

Technology Education refers to educating children to employ the hardware and software of technology according to the technological categories explained under

the definition of Technology above, that is, the tangible and intangible sides of technology. It includes the education theory and practice of a range of material processes for metal, wood, plastics, textile, leather and food materials. All these have a component of learning theory but the greater and more important is that of gaining practical experience (Kumar, 2002, p. 125).

In Technology Education students learn about designs of artifacts, materials that they use, and the processes involved. The knowledge dimensions can come from different fields of technology such as Food Technology, Textile Technology, Transport Technology, Mining Technology, and so forth, which are tangible in nature, or intangible technologies which have been explained earlier in this chapter. There are a range of skills that students learn alongside knowledge in Technology Education: designing, decision making, evaluation, communication, time management, collaboration, problem-solving, and a whole lot more skills.

DEFINING CURRICULUM AND PEDAGOGY

The crux of this chapter is teaching. This creates a need to define pedagogy. But teaching is an aspect of curriculum. Therefore, a related need is to define curriculum as well. According to Perso (2012, p. 31), "curriculum is a broad concept that includes knowledge and content, delivery and teaching, assessment and even reporting to parents.'' Perso's (2012, p. 31) working definition befits the context of the current discussion in this chapter; particularly that curriculum is the "intended and planned learning proposed by the system, school and classroom teacher." This definition is appropriate because it does not limit the design and implementation of curriculum to the school, but includes the teacher as well. In fact, the teacher is the important role-player because we see practically, the enactment of curriculum through teachers. The teacher is the main implied actor in this chapter because teachers are the ones who teach. With this in mind, then, pedagogy is the enactment of the curriculum (Perso, 2012, p. 31). Enactment implies the methods and delivery styles that the teacher uses to bring about the desired learning. Perso (2012, p. 31) states further that "student behaviour in the classroom is largely determined by the pedagogies used by the classroom teacher and the way that each student experiences the enacted curriculum." According to Perso, curriculum, pedagogy and behaviour are closely connected and interdependent. The big question is then, "What is the teacher doing with the curriculum in relation to the student?" Teaching heavily depends on teachers' reading and interpretation of the intended curriculum and their preparedness to attend to the needs of their students (Perso, 2012, p. 44). Place-based pedagogies, that is, pedagogies which are relevant to the student's milieu, are a need in indigenous context in order to connect between the lived experiences and aspirations of indigenous students and their communities and schooling and work (Perso, 2012, p. 44). Fogarty (2010) is of the view that a pedagogic framework is needed to ensure the accommodation of indigenous perspectives in the teaching context. The academic performances of indigenous students have been found to

improve when schools promote their language and culture in curricula (Demmert, 2001).

Teaching is based on oral and written instruction, symbols, stories, proverbs, singing, dramatizing, observing, repeating, imitating, memorizing and participating. In indigenous African education, observation and memory take precedence as pedagogical styles—names of animals and plants, size and type/shape of horns of animals (Elleni, 1995). What this boils down to is that the teacher should be conversant with pedagogical styles that can spice up the conventional ones for the sake of making the subject matter relevant to indigenous students as well. Table 1 shows strategies that are prevalent in indigenous ways of teaching in Aboriginal settings (many indigenous communities could identify with these strategies) compared to those which dominate conventional mainstream teaching.

Table 1. Learning styles in aboriginal and mainstream pedagogies compared

Traditional aboriginal learning styles (If students are from traditional indigenous backgrounds it is likely they have a preference for…)	*Mainstream learning styles*
Observation and imitation	Verbal and oral instruction
Personal trial/ and error, and feedback	Verbal instruction accompanied by demonstration
Real-life performance/learning from life experiences	Practice in contrived/artificial settings
Mastering context specific skills	Abstract context-free principles that can be applied in new, previously inexperienced situations
Person-oriented (focus on people and relationships)	Information-oriented
Spontaneous learning	Structured learning
Holistic learning	Sequential and linear learning

Source: Hughes and More, 1997

It should be noted that the fact that verbal and oral instruction is classified under the mainstream learning style column in Table 1 does not imply that it is absent in indigenous teaching. In fact, it is very evident in indigenous education (Elleni, 1995) and that is why it is mentioned as one of the pedagogical principles. The understanding that should be created here is that in mainstream learning, oral and verbal presentations dominate teaching in a confined learning environment such as the classroom. In open, traditionally authentic settings, oral and verbal teaching is balanced with observation and imitation.

TECHNOLOGY TEACHING NEEDS TO CHANGE

Tension mounts nationally and internationally about whether schools should teach indigenous cultural content (Perso, 2012). It is high time that this tension transitions to a discourse about teaching this content and how that should be done. The dominant cultural values are those of the majority of teachers—white, middle class—which downplays the strengths of students from different cultures. This forms a blockade for teachers not to appreciate what their students have to offer in classroom discourses. In the teaching of technology this is very unfortunate considering the opportunity that the subject offers for students to showcase their thinking through the projects that they complete. Gribble (2002) argues that while emphasis is placed on children's learning styles and their socio-cultural context, the curriculum fails to empower them. Gribble (2002) blames this on the teachers' inability to define or determine the valued knowledge to teach from different social and cultural contexts.

The teachers' failure to rightly accommodate indigenous students in their teaching is informed by the forces that have conceptualized and perpetrated the curriculum of Technology Education, and the teaching thereof, from a purely western perspective. In England and Wales, for example, the Technology Education curriculum is accused of being biased towards black students. Eggleston (1992, p. 59) argues that the authorities' declaration: "Technology Education should be taught to *all* children, black or white" might not be achieved until the sources of the powerful social pressures that have for generations differentiated technological achievement by race are understood. Eggleston (1992, p. 64) cites the Final Report of "The Design and Technology Working Group" that states:

> Cultural diversity has always been a feature of British life…[providing] a richer learning environment for all…the teaching of design and technology will require perceptiveness and sensitivity from teachers' [to take account of] different beliefs and practices, especially when food, materials and environmental designs are involved…there are rich opportunities here to demonstrate that no one culture has the monopoly of achievements in design and technology.

However, Eggleston (1992) explains his disappointment that the recommendations of "The Design and Technology Working Group" have not been heeded. According to Eggleston (1992), indigenous cultures which, because of certain realities in this world, have come from elsewhere into England and Wales, are being denied formal platform in the school curriculum to have their perspective of life represented. Layton (1993) declares that learners should be exposed to the fact that artifacts, systems or environments from other cultures, have identifiable characteristics and styles and draw upon this knowledge in design and technological activities. Design and Technology could and should then provide not only equal but enhanced

opportunities for young people who have, so far, not found it easy to make it in the more traditional areas of the curriculum (Eggleston, 1992). According to Eggleston (1992. p. 65), the curriculum should present opportunities for young black people to compete on more equal terms with white children in the subject.

As indicated above, this racial orientation within the Technology Education curriculum informs the biased teaching approach of teachers. They hold certain connotations about students from non-English and Welsh cultures. In *Teaching Design and Technology*, Eggleston (1992) captures the racially motivated assumptions that white teachers hold about black students regarding their work: they do a messy job; they cannot be given access to the examination because they lack motivation; they will be handicapped by language; they lack the appropriate cultural background; they fail to understand the system; they will not know how to work hard; they will have behavioural problems and be disruptive. These students are perceived this way because they struggle to come to terms with curriculum and teaching that fail to accommodate their worldview.

The second example is from the American context. Educational literature is silent on teaching African-American students (Ladson-Billings, 2000). Much of educational research has focused on generic models of pedagogy (Shulman, 1987). Shulman (1987) proposes a framework for a teacher's pedagogical content knowledge. Knowledge of students and their characteristics, educational contexts and values form part of the framework (Shulman, 1987). But the transformation framework of Shulman and others are yet to thrive against the opposing models. One such model is the 19th century Americanization model. This model was designed to merge all students regardless of their ethnic or cultural origins into one ideal model (Ladson-Billings, 2000). A model such as this could be supported if equity and equality were uncompromised standards. But the intentions of the model were utterly biased. Ladson-Billings (2000, p. 207) exposes this intention as follows:

> Of course, this Americanization process considered only those immigrant and cultural groups from Europe. Indigenous peoples and people of African descent were not thought educable and therefore not a part of the mainstream educational discourse.

For many years the education of African-American students was left to be the responsibility of African-American communities but through state-supported segregated schooling systems (Ladson-Billings, 2000). Although the ideal was to have integrated schooling of students, African American teachers felt more comfortable teaching African-American students in the schools, in African American community settings, as they would feel the freedom to adopt a critical stance to the curriculum and pedagogy (Foster, 1990). Due to white supremacist assertions which claim that African-Americans are genetically inferior and not fully human, the expectation for educating them has been low (Allen cited in Ladson-Billings, 2000).

Zuga (1997) is aware of the existence of the biased treatment of students in the American school system based on their ethnic backgrounds, expressed in terms of students' attitudes towards the Technology Education curriculum. Zuga (1997) notes the long-time omission of ethnic differences in this research area, which could inform technology teachers about curriculum. For instance, African-American and Native-American students could have value conflicts with the western approaches to Technology Education. This omission disregards the realities of the multicultural nature of the American society and can therefore be attributed to a tendency to view Technology Education hegemonically (Zuga, 1997). The third example relates to the struggles of Aborigines in Australia. Most indigenous parents do not want their children to lose out on their indigenous worldview even though they are not opposed to the national standards curriculum (Perso, 2012). Perso (2012), in concurrence with Forgaty (2010), quotes from a Select Committee on Aboriginal Education appointed in 1985 by the House of Representatives, which among others identified two key needs for indigenous education:

- Desire to gain English literacy and numeracy; and
- Desire to preserve Aboriginal identity and to have education as far as possible provided in their local communities so that children could remain in communities to be raised as Aboriginals.

This seems a balanced situation between the mainstream curriculum and indigenous perspectives. Tripcony (2010, p. 5) is of the view that while children should be able to confidently communicate with and work within mainstream organizations, they should maintain "their own unique identities and connections with their families, communities and cultures." Fogarty (2010) observes a transition in the Australian Northern Territory indigenous community caused by the evolving culture, suggesting the complimentarity and interaction between the western and indigenous knowledges that should be brought upon by the learning and schooling programs. Fogarty (2010), on the contrary, observes what seems to be a constant rejection by indigenous people in remote regions, of some form of the mainstream employment such as mining, rather choosing the options that make them stay connected to their communities to fulfil kinship and customary obligations.

The above examples suggest that teachers should re-examine their pedagogical approaches and strategies. They should show an interest in the culture of their students and be prepared to learn along with them. Culture is deeper than just understanding someone's ethnicity, race and faith; it includes broad notions of similarity and differences as well as students' multiple social identities and ways of knowing and of being in the world (Ontario Capacity Building Series, 2013). Effective instruction includes:

- Approaching curriculum in a flexible manner to tease out informal and subtle information, and adaptation of the curriculum to the students' lived experiences;

- Inquiry-based learning to ensure self-directed learning in students;
- Use of a variety of resources, which include community partners to facilitate learning;
- Knowing and building on students' prior knowledge, interests, strengths and learning styles;
- Engaging a broad range of students to draw from varied students' perspectives and varying instruction by employing different methods and opportunities; and
- Developing the socio-cultural consciousness of students through curriculum approaches.

(Montgomery, 2001, pp. 4–8; Ontario Capacity Building Series, 2013, pp. 6–7)

These effective strategies are informed by frameworks that are opposed to teacher dominance and linear pedagogical approaches. A few of these frameworks are presented in the next section.

FRAMEWORKS FOR ENSURING THE INCORPORATION OF STUDENTS' KNOWLEDGE IN TEACHING

Alternative theories and models such as the southern theory, the culturally relevant teaching model, the sociocultural constructivist model, the community of practice, the blended model, participatory modelling, and personal mental models (Wenger, 1998; Ladson-Billings, 1994, 2000; Yishak & Gumbo, 2012; Wahyudi, 2014; Fleer, 2015; Yishak & Gumbo, 2015) should be considered. The southern theory promotes multi-centred social science perspectives, social science critiques, social sciences that produce many forms of knowledge, and social science that is relevant to democracy (Wahyudi, 2014).

Culturally relevant teaching (Ladson-Billings, 1994, 2000), which other scholars term culturally responsive teaching or culturally responsive pedagogy (Gay, 2000, 2002; Montgomery, 2001; Villegas & Lucas, 2002; Grant, 2010), is about teaching that integrates a student's background knowledge and prior home and community experiences into the curriculum and the teaching and learning experiences that take place in the classroom. All students learn differently and that is informed by their background, language, family structure and social or cultural identity. Scholars allude to the three tenets of culturally responsive pedagogy: institutional, personal and instructional (Ontario Capacity Building Series, 2013). Instructional implies in this case, "knowing students well and considering the classroom practices which lead to a culturally responsive classroom" (Ontario Capacity Building Series, 2013, p. 2).

Vygotsky's theory of constructivism promotes instructional approaches that support student-focused learning environments (Subban, 2006). Social constructivism is about building onto students' varied lived experiences to enliven the curriculum, enhance the value of locally situated learning, and develop inquiry-based learning to ask questions and create knowledge (Ontario Capacity Building Series, 2013). Social constructivism promotes collaborative learning where students appreciate varied expressions of

knowledge in their activities. Vygotsky's theory raises the need on the part of the teacher to cater to the students' diverse learning styles in a sociocultural context (Subban, 2006). Students who engage in collaborative learning conditions experience more constructive learning processes (Zhu, 2012). According to Shackelford and Maxwell (2012), constructivism ensures cognitive, social and teaching presence. Cognitive presence is about students' ability to construct meaning through sustained communication in the learning community context (Shackelford & Maxwell, 2012). Cognitive presence showcases the exploration, construction, resolution and confirmation of students' understanding of the content (Garrison cited in Shackelford & Maxwell, 2012). Social presence implies the ability of students to project themselves socially and emotionally through communication (Shackelford & Maxwell, 2012).

Lave and Wenger (1991) coined the concept of 'community of practice' as they explored apprenticeship as a representation of situated learning. What this theory tries to communicate is that learning is a communal event in a social sense. A community of practice encapsulates the ideals of a social theory. According to Wenger (1998, p. 5), the four core units of the social theory of learning involve:

- *Meaning* – an avenue to express a non-static competence personally and communally, in order to know existence and humanity as significant.
- *Practice* – an opportunity to share the past and communal resources capable of sustaining communal engagement.
- *Community* – an environment that encourages discourse about communal set-ups where human endeavours are made clear as worth trailing and involvements are identifiable as proficiency.
- *Identity* – path taken to discuss how learning transforms human personalities by creating individual chronologies that lead to *becoming* within the confines of the environment.

Yishak and Gumbo (2015) have considered a few models that could be considered for teaching indigenous students, that is, standalone, restructured or blended models. These authors recommended a blended model without compromising the fundamentals of a standalone model. The blended model integrates both the indigenous knowledge systems and western or mainstream knowledge systems.

There are also other models such as participatory modelling (Standa-Gunda, Mutimukuru, Nyirenda, Prabhu, & Haggith, 2003). Models in varied forms such as personal mental models, mathematical equations and physical models, represent people's understanding of the world (Standa-Gunda et al., 2003). Models are useful in decision making, exploration of new possibilities and to facilitate understanding (Standa-Gunda et al., 2003). "The combination of modelling and participation can create a productive environment conducive for social learning, but this is only achieved with good facilitation" (Standa-Gunda et al., 2003, p. 315). The deliberations in this chapter thus far suggest the transformation of pedagogical principles about teaching technology by integrating indigenous perspectives.

TECHNOLOGY EDUCATION AND THE PEDAGOGICAL PRINCIPLES THAT INTEGRATE INDIGENOUS PERSPECTIVES

Promoting a Collective Approach to Learning and Design Projects

A person can find their true meaning by viewing themselves through the community they are members of—the membership of which is by cultural ties and values. No doubt, collectiveness has characterized indigenous societies over centuries. The communal orientation of indigenous societies versus individualism that informs capitalism in western societies is reason to invest in the collective learning approach in Technology Education. Those who are committed to culturally responsive pedagogy (Ontario Capacity Building Series, 2013) are in turn "committed to collective, not just merely individual empowerment" (Ladson-Billings, 1995, p. 160). From a socio-cultural perspective:

> Social learning is a collective process for accumulating new knowledge essential for problem solving, decision making and community development. Social learning can be a powerful force for change, through collective interaction at the community level. It involves critical thinking about the underlying assumptions concerning stakeholder action, values and claims to knowledge. (Standa-Gunda et al., 2003, pp. 315–316)

The collective engagement of students is fostered when they think about and participate in design projects. The teacher should encourage teamwork or the use of a collective approach in design tasks; for example, when conceptualizing solutions to technological problems. It should not merely be a group work approach.

Inculcating a Holistic View to Knowledge and Phenomena

True understanding of nature is achieved through viewing it as an integrated whole, that is, through an eco-systemic view. Thus, knowledge is not linear, nor is it the logical compartmentalization of things as science classifies it; rather, it is integrated and inter-disciplinary. Watson and Chambers (1989) write that a western society is economics- and competition-driven, which culminates into knowledge that is characterized more by measurement and comparison, whereas an indigenous society gives primacy to a genealogical kinship. This means that the technology teacher should adopt a holistic approach to teaching and learning. He or she should be open to alternative forms of knowledge that students can incorporate in their learning. This is where indigenous students will contribute integrated knowledge systems (for example, their beliefs, values and spirituality) into their design ideas, like suggesting a shape that is attuned to their cultural milieu or a particular value system in the design of an artifact.

Adopting a Co-Creative Orientation Towards Knowledge

Knowledge is co-created and community-owned rather than individualized; with elders being the libraries of such knowledge they possess the richness of indigenous

knowledge. The creation of knowledge by indigenous students does not begin and end in the classroom. Elders in their communities share important knowledge that includes technological knowledge, knowledge which could be referred to as "tech knowledge" due to its practical nature. The co-creation of knowledge happens as students consult and interact with each other in a learning situation, but that extends beyond the borders of school into consulting their community members. Thus, "teachers need to design work units and tasks with knowledge of their students and their needs in mind, particularly the ways in which they learn and the ways they communicate" (Perso, 2012, p. 32). Curriculum should as well focus on the local community context and empower students such that they can create their own jobs and become entrepreneurs to uplift their communities (Perso, 2012). This would mean that the technology teacher should nurture design projects that have relevance to the students' environment. They should help identify the technological needs and/or wants in the societies that students are members of so that students always design from their milieu. Schools should therefore help students realise the relevance of what they are learning in the classroom so that those who do not wish to leave their communities in search of jobs elsewhere can stay and benefit their communities (Perso, 2012).

Encouraging a Cooperative and Negotiated Approach Towards Problem Solving

Frameworks such as those discussed above can be used in problem-solving activities. A Lekgotla model applied in many indigenous societies to address problems can be considered. The Lekgotla model originates from the "tribal" meeting where village issues are addressed. Men of the village would sit in an arranged place to discuss the issues of the village. Protocol would be observed, that is, the most senior person would speak first followed by the next down to the least. This is still happening in the family environments, for example, during the lobola (dowry) negotiations. A delegation consisting of uncles and aunts of the groom-to-be will be requested by the groom-to-be's parents to request a meeting with the similar delegation on the bride-to-be's side to negotiate lobola. These groups are honoured with this important role and are responsible to advise and facilitate the marriage between the bride and the groom. A modified version of this model can be used in Technology Education to ensure all students' participation in their groups when they engage in problem-solving activities. Sub-groups can be delegates who will think about solutions to the problem and meet to negotiate solutions. They can role-play Lekgotla when they negotiate solutions to the identified problems in their learning activities.

Standa-Gunda et al. (2003) used the participatory model and social learning to engage twenty-eight broom grass harvesters (who made brooms from grass to sell) in Zimbabwe in developing solutions to the depletion and possible extinction of the grass. The end users preferred the brooms made from the grass that was harvested with its roots because the brooms were long- lasting compared to the brooms made

from the grass without roots. While this was a preference for the end users it created the grass depletion problem. The participants were thus involved in a discussion to arrive at a decision on how to sustain the grass. The group generated solutions for possible actions such as harvesting the grass at the right season, planting the seeds, stopping the harvesting of the grass with its roots and so forth. It can be realised that participation driven by collective engagements and a common goal is important in problem-solving situations—an ideal model for problem-solving activities in Technology Education.

Collaboration is central in these models and/or the theories discussed above. Lavonen et al. (2004) state that in Technology Education, collaboration features prominently as a pedagogical strategy. Collaboration is social interaction within a group or team. In such a dynamic, students work together for a common outcome. They establish joint goals and referents, arrive at joint decisions, solve emerging problems, construct and modify solutions and evaluate the outcomes through dialogue and action (Lavonen et al., 2004). Students actively communicate and work together to produce an outcome, and evaluate their outcome through dialogue and action.

Enriching Learning with Experiential Knowledge of the Elders

The young are mostly taught through observation by keeping them close to elders engaged in activities of the day. Thus, education mostly happens through experience, demonstration and observation. During Kimbell's (2008) touring of Zambia he observed the construction of a dhow at a beach site, which is a 25 feet long traditional Red Sea/Indian Ocean sailing craft. Raw materials (typically branches or trunks of teak) were shaped and fixed by hand without a single drawing. Kimbell (2008) claims that the builders knew about the strength of the timber and how to shape and fix it. Kimbell reflected on tacit knowledge (knowledge that is difficult to transfer to another person by means of writing it down or verbalising it), which he thought was involved as he observed new members of the building group being progressively inducted by participating in what he referred to as the mysteries of the trade of building the sailing craft. What this suggests is that the technology teacher should consider inviting elders who possess this expert knowledge to come and demonstrate how they do problem solving in their environment. Alternatively, educational tours should not only concentrate on industry in urban environments, but should also be spread to indigenous environments to tour indigenous factories or manufacturing sites such as dhow building. The role that indigenous community members can play in education should not be undermined. Consideration of tacit knowledge means that the teaching of technology should not follow the blueprint of the design process always, that is, investigate, design, make, evaluate and communicate.

Including Orality as an Alternative Form for Reporting or Communicating about Projects

Knowledge is mostly shared or transmitted through oral communication. Oral communication plays a huge role in indigenous societies, for example, in reporting, teaching about proverbs, idioms and riddles, telling stories. Elders who possess this rich knowledge have been perceived as living or walking libraries as a result. Since technology students are required to report and market their design projects, orality should be valued as a learning style (see my comments on Table 1 above), rather than overemphasising written reporting or marketing.

Building a Learning Community through Ubuntu

Knowledge about core cultural values is essential. The young are taught respect, responsibility, unity and so forth. The fundamental belief is that *motho ke motho ka batho ba bangwe (Tswana)* (Mokgoro, 1997); *umuntu ngumuntu ngabantu (Zulu)* (Mokgoro, 1997; Nyaumwe & Mkabela, 2007); *munhu munhu ngevamwe (Shona)* (Nyaumwe & Mkabela, 2007), which, literally translated, means a person can only be a person through others (Mokgoro, 1997; Nyaumwe & Mkabela, 2007). In most indigenous societies, young ones are taught Ubuntu institutionally, such as, in initiation schools. In this kind of existence, one person's personhood and identity is fulfilled and complemented by the other person's personhood. Each person *is* because the other person *is*. Each person *exists* because the other person *exists* (Muwanga-Zake, 2009). In his groundbreaking work *Let Africa Lead,* Khoza (2005, p. 269) defines *Ubuntu* as "an African value system that means humanness or being human, a worldview characterized by such values as caring, sharing, compassion, communalism, communocracy and related predispositions." Khoza (2005) adds that although *Ubuntu* is an African term, its philosophy can have a universal application, especially in indigenous societies as it can be seen with its Aboriginal conception related above. In 2010, during the author's scholarly visit at the University of Waikato, in New Zealand, the author toured the Maori Cultural Village, during which he observed the values that relate to *Ubuntu*: singing, unity, respect, communality, etcetera. The principles of *Ubuntu* can benefit teaching in Technology Education where students are called upon to exercise responsibility over their learning activities, such as cleaning their work spaces. The principles of *Ubuntu* can also be used as the basis for collectiveness and collaboration. That way they will learn to value each other's contribution and celebrate their achievement as a collective.

Accommodating Learners' Design Ideas That Could Be Informed by Spirituality

Part of indigenous knowledge is held as sacred as it is believed to be divinely revealed by the Creator. Knowledge about nature cannot be divorced from the Creator

and this facilitates the perpetration of a moral responsibility over nature which is taught even to the young through expressions, idioms or riddles. According to Harris (1990), (Aboriginal) indigenous world views are informed by spiritual and religious beliefs, while western cultures are informed by science. As indicated earlier on, designs and artifacts in indigenous environments are mostly influenced by the belief systems prevalent in such environments. In the open indigenous markets one notices human face sculptures and masks as well as animals and birds. These relate very closely to the designer's and end user's belief world, for instance, animals as totems. This also ties well with holism in the sense that indigenous designers mostly make artifacts that reflect nature. Hence, technology teachers should be aware of what informs design ideas of indigenous students in order to devise strategies to accommodate them appropriately. For example, a young Zimbabwean inventor, Sangulani Chikumbutso, exhibited his technological prototypes on 20 July, 2015, reported on the website: http://thisisafrica.me/zimbabwean-inventor-sangulani-chikumbutso-unveils-amazing-new-prototypes/ (This is Africa, 2015). These prototypes, among others, include:

- a hybrid engine-powered helicopter, which runs on six different fuels without any need to make adjustments on the engine, a unique innovation element which will help to draw market interest;
- an electric car, which runs on a renewable micro-sonic energy device with zero emission, another innovation element which brings the aspect of environmental friendliness to the design;
- a magnetic converter;
- a green power generator, which promises to revolutionise the energy sector as it is also powered by a micro-sonic energy device, and it generates electrical power by converting radio frequency energy directly into electricity;
- a special drone; and
- a SD-HDMI transmitter and receiver for mobile surveillance, which can transmit and receive the wireless high definition video and audio signals from SAITH-HDMI transmitters with high receiving sensitivity.

The prototypes promise to bring to the fore unique inventions that will benefit his country and the world. According to TechZim (This is Africa, 2015), Sangulani had already begun to experiment with electrical technology when he was at primary school. But then his father's influence as a mechanic aroused his interest to become a mechanic. Today Sangulani owns a company called SAITH Technologies. SAITH is a Biblical word from a phrase *Thus saith the Lord.* Sangulani's story is that his designs are God revealed, hence he decided to name his company SAITH Technologies. As a technology teacher, imagine having a learner like Sangulani in your class. What would be your response to his design ideas? He claims that his design ideas were spiritually discerned as well as inspired by the experiential knowledge endowed in his father as an elder.

Using Values as a Tool to Cultivate a Deeper Understanding of Technology in Terms of Its Biases and Impact

Knowledge, and therefore science, is not value-free as it cannot be divorced from the cultural and value systems of indigenous societies. An attempt should be made to make the school and home experiences of diverse students more congruent (Ladson-Billings, 2000). Indigenous people everywhere would like to know about their culture and history, which suggests a collaboration between parents and teachers to raise kids (Perso, 2012). Knowing about the value system of indigenous students can help in positioning the technology teacher appropriately to teach about values (religion, beliefs, culture, education, etc.), which is an integral part in the learning of technology.

Accommodating the Complex Dimensions of Knowledge for Meaningful Learning

Indigenous knowledge's rich complexity is found in ceremonies and rituals, for instance, dance, music, storytelling, folktales, epic, poetry, recitation, demonstration, (word) games, sport, praise, riddles, reasoning, puzzles, tongue-twisters. What is desired, then, is teachers who are capable of interrogating the curriculum from a culturally responsive perspective as they attempt to determine their strengths and weaknesses (Perso, 2012). Their interrogation should target things such as accuracy, purpose, significance, authenticity of narrative texts, visual illustrations, learning activities and authorial sources (Perso, 2012). At the same time, they should expose and confront racism, stereotyping, distortions and overemphasis on factual information (Perso, 2012). This list, juxtaposed to Table 1, provides a repertoire of strategies that can be considered in technology teaching.

CONCLUSION

The teaching of technology needs to transform to include indigenous perspectives. The literature surveyed and presented in this chapter attests to this need. I addressed the purpose of the chapter by defining the terms Technology, Technology Education, Curriculum and Pedagogy; highlighted the need to transform the teaching of technology; presented the frameworks that support the integration of indigenous perspectives in technology teaching; and presented the ten principles about teaching technology from an indigenous perspective.

Schools and teachers should re-examine their teaching strategies and make sure that they do not alienate indigenous students in their classes. They should ensure that they integrate indigenous knowledge systems in the Technology Education curriculum.

REFERENCES

Apple, M. W. (1986). *Teachers and texts*. New York, NY: Routledge & Kegan Paul.

Batiste, M. (2002). *Indigenous knowledge and pedagogy in first nations education: A literature review with recommendations*. Ottawa: National Working Group on Education and the Minister of Indian Affairs. Retrieved March 1, 2012, from www.afn.ca/uploads/files/education/24_2002_oct_marie_battiste_indigenousknowledgeandpedagogy_lit_review_for_min_working_group.pdf

Demmert, W. (2001). *Improving schools' academic performance among Native American students: A review of the research literature*. Charlston, WV: ERIC Clearinghouse on Rural Education and Small Schools.

Department of Basic Education (DBE). (2009). *DoE 2009. Report of the task team for the review of the implementation of the national curriculum statement. Final report*. Pretoria: Government Printers.

Department of Basic Education (DBE). (2011). *Curriculum and assessment policy statement Grade 7–9 technology*. Pretoria; Government Printers.

Dugger, W. (2008). *The perspective of technology education*. A paper presented at the Japanese International Symposium of Educational Cooperation for Industrial Technology Education. Aichi, Japan.

Eggleston, J. (1992). *Teaching design and technology: Developing science and technology Education*. Buckingham: Open University Press.

Eggleston, J. (1996). *Developing science and technology education: Teaching design and technology* (2nd ed.). Buckingham: Open University Press.

Elleni, T. (1995). *Sankofa: African thought and education*. New York, NY: Peter Lang.

Emeagwali, G. (2003). African indigenous knowledge systems (AIK): Implications for the curriculum. In T. Falola (Ed.), *Ghana in Africa and the world: Essays in honour of Adu Boahen*. New Jersey, NJ: Africa World Press.

Fleer, M. (2015). Theorising technology education from a cultural-historical perspective: Foundations and future imaginings. In P. J. Williams, A. Jones, & C. Buntting (Eds.), *Contemporary issues in technology education: The future of technology education* (pp. 35–55). Singapore: Springer.

Fogarty, W. P. (2010). *Learning through country: Competing knowledge systems and place based pedagogy* (Unpublished Thesis). Australian National University, Canberra, ACT.

Foster, M. (1990). The politics of race: Through African American teachers' eyes. *Journal of Education, 172*, 123–141.

Gay, G. (2000). *Culturally responsive teaching: Theory, practice and research*. New York, NY: Teachers College Press.

Gay, G. (2002). Preparing for culturally responsive teaching. *Journal for Teacher Education, 53*(2), 106–116.

Grant, M. M. (2010). *Culturally relevant collective responsibility among teachers of African-American students in a high poverty elementary school* (Unpublished Dissertation). Ohio State University, Ohio, OH.

Gumbo, M. T. (2014). Elders decry the loss of Ubuntu. *Mediterranean Journal of Social Sciences, 5*(10), 67–77.

Gumbo, M. T. (2015). Indigenous technology in technology education curricula and teaching. In P. J. Williams, A. Jones, & C. Buntting (Eds.), *Contemporary issues in technology education: The future of technology education* (pp. 57–75). Singapore: Springer.

Harris, S. (1990). *Two-way schooling*. Canberra: Aboriginal Studies Press.

Hughes, P., & More, A. J. (1997). *Aboriginal ways of learning and learning styles*. Annual Conference of the Australian Association for Research in Education, Brisbane, Australia.

Indiana Technology Education Curriculum Standards. (2006). *Technology education content standards booklet*. Indianapolis, IN: Indiana Department of Education.

Khoza, R. J. (2005). *Let Africa lead*. Sunninghill: Vezubuntu.

Kimbell, R. (2008). Indigenous knowledge, know-how, and design & technology. *Design and Technology Education: An International Journal, 10*(3), 8–10.

Kumar, K. L. (2002). Impact of new technology on teaching and learning in technology education. *Design and Technology Association International Research Conference.*

Ladson-Billings, G. (1994). *The dream-keepers: Successful teachers of African American children*. San Francisco, CA: Jossey-Bass.

Ladson-Billings, G. (1995). Toward a theory of culturally relevant pedagogy. *American Educational Research Journal, 32*(3), 465–491.

Ladson-Billings, G. (2000). Fighting for our lives: Preparing teachers to teach African American students. *Journal of Teacher Education, 51*(3), 206–214.

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation.* Cambridge, UK: Cambridge University Press.

Lavonen, J., Autio, O., & Meisalo, V. (2004). Creative and collaborative problem solving in technology education: A case study in primary school teacher education. *The Journal of Technology Studies, 30*(2), 107–115.

Layton, D. (1993). *Technology's challenge to science education*. Buckingham: Open University Press.

Masango, M. J. S. (2006). African spirituality that shapes the concept of ubuntu. *Verbum Et Ecclesia Jrg*, *27*(3), 930–943.

Moalosi, R., Popovic, V., Kumar, K. L., & Hudson, A. (2005). *Product analysis in relation to the socio-cultural perspective of Botswana*. Paper presented at International Conference on Design Education, Ahmedabad, India.

Mokgoro, J. Y. (1997). *Ubuntu and the law in South Africa*. Colloquium Constitution and Law. Potchefstroom, South Africa.

Montgomery, W. (2001). Creating culturally responsive, inclusive classrooms. *Teaching Exceptional Children, 33*(4), 4–9.

Msila, V. (2007). From apartheid to the revised national curriculum statement: Pedagogy for identity formation and nation building in South Africa. *Nordic Journal of African Studies, 16*(2), 146–160.

Muwanga-Zake, J. W. F. (2009). Building bridges across knowledge systems: Ubuntu and participative research paradigms in Bantu communities. *Discourse: Studies in the Cultural Politics of Education, 30*(4), 413–426.

Ngara, C. (2007). African ways of knowing and pedagogy revisited. *Journal of Contemporary Issues in Education, 2*(2), 7–20.

Nyaumwe, L. J., & Mkabela, Q. (2007). Revisiting the traditional African cultural framework of ubuntuism: A theoretical perspective. *Indilinga – African Journal of Indigenous Knowledge Systems, 6*(2), 152–163.

O'Riley, P. (2001). *A different storytelling of technology education curriculum revisions: A storytelling of difference*. Retrieved September 12, 2015, from http://scholar.lib.vt.edu/ejournals/JTE/v7n2/pdf/oriley.pdf

Ogunbure, A. A. (2011). The possibilities of technological development in Africa: An evaluation of the role of culture. *The Journal of Pan African Studies, 4*(3), 86–100.

Ontario Capacity Building Series. (2013). *Culturally responsive pedagogy: Towards equity and inclusivity in Ontario schools*. Retrieved September 4, 2015, from www.edu.gov.on.ca/eng/literacynumeracy/inspire/

Perso, T. F. (2012). *Cultural responsiveness and school education: With particular focus on Australia's First Peoples – A review and synthesis of the literature*. Darwin Northern Territory: Menzies School of Health Research, Centre for Child Development and Education.

Pudi, T. I. (2006). *Technology education (Study Guide)*. Pretoria: Unisa Press.

Robyn, L. (2002). Indigenous knowledge and technology: Creating environmental justice in the twenty-first century. *The American Indian Quarterly, 26*(2), 198 –220.

Seemann, K. W. (2000). *Technacy education: Towards holistic pedagogy and epistemology in general and indigenous/crosscultural technology education*. International Technology Education Research Conference, Gold Coast, Australia.

Senanayake, S. G. J. N. (2006). Indigenous knowledge as a key to sustainable development. *The Journal of Agricultural Sciences, 2*(1), 87–94.

Shackelford, J. L., & Maxwell, M. (2012). Sense of community in graduate online education: Contribution of learner to learner interaction. *The International Review of Research in Open and Distance Learning, 13*(14), 228–250.

Shulman, L. (1987). Knowledge and teaching: Foundations of the new reform. *Harvard Educational Review, 57*, 1–22.

Standa-Gunda, W., Mutimukuru, T., Nyirenda, R., Prabhu, R., & Haggith, M. (2003). Participatory modelling to enhance social learning, collective action and mobilization among users of the Mafungaitsi Forest, Zimbabwe. *Small-Scale Forestry, 2*(2), 313–326.

Stevens, A. (2005). *Technology teacher education in South Africa*. Retrieved July 24, 2015, from www.iteaconnect.org/Conference/PATT/PATT15/Stevens.pdf

Subban, P. (2006). Differentiated instruction: A research basis. *International Education Journal, 7*(7), 935–947.

This is Africa. (2015). *Zimbabwean inventor unveils amazing new prototypes*. Retrieved August 20, 2015, from http://thisisafrica.me/zimbabwean-inventor-sangulani-chikumbutso-unveils-amazing-new-prototypes/

Tripcony, P. (2010). *Indigenous children and youth: Issues and underlying factors*. Background paper to presentation by Dr. Penny Tripcony, Child Protection Peak, Ltd.

Wahyudi, R. (2014). "Democratic" online courses as "glocalized communication" in English language teaching and applied linguistics: A proposal. *Journal of Global Literacies, Technologies, and Emerging Pedagogies, 2*(3), 248–260.

Watson, H., & Chambers, D. W. (1989). *Singing the land, signing the land*. Geelong: Deakin University Press.

Williams, A. (1996). What is technology? In J. Williams & A. Williams (Eds.), *Technology education for teachers* (pp. 1–26). Melborne: MacMillan.

Yishak, D. M., & Gumbo, M. T. (2012). Indigenising the school curriculum: An alternative approach for ensuring relevance to the context. *Indilinga–African Journal of Indigenous Knowledge Systems, 11*(2), 179–193.

Yishak, D. M., & Gumbo, M. T. (2014). A stand-alone, blended or restructured approach to the indigenization of curriculum? A critical perspective. *International Journal of African Renaissance Studies, 10*(1), 60–82.

Zhu, C. (2012). Student satisfaction, performance, and knowledge construction in online collaborative learning. *Educational Technology & Society, 15*(1), 127–136.

Zuga, K. F. (1997). An analysis of technology education in the United States based upon a historical overview of contemporary curriculum research. *The Journal of Design and Technology Education, 7*(3), 203–217.

YOVITA GWEKWERERE

3. SCHOOLING AND THE AFRICAN CHILD

Bridging African Epistemology and Eurocentric Physical Sciences

INTRODUCTION

In recent years, a few African countries have experienced some economic growth but most still struggle to meet the basic needs of their citizens. Education plays a vital role in the development of human capital needed to ensure more sustainable economies. More importantly, development of locally relevant scientific knowledge is needed for inventions of sustainable technologies that utilize locally available resources. In order to ensure the development of locally relevant scientific knowledge, physical science subjects taught in African schools must be relevant and applicable to the African context. Physical science subjects are essential for the development of sustainable technologies in the sense that they are directly linked to understanding how technologies work, which can lead to the development of newer technologies. Hence, finding ways to make the physical science subjects taught in African schools more relevant and applicable to the African context is critical. This chapter interrogates the connection that exists between the physical science subjects taught in school and the real-life experiences and worldviews of the African child. The chapter also provides some ideas for contextualizing physical science in order to make it more relevant and applicable to the African context.

Science educators in non-western countries have long realized that a gap exists between Western science taught in schools and other traditional worldviews (Aikenhead, 2011; Nashon, 2004). This gap has resulted in low achievement rates in science subjects as well as low representation of indigenous peoples in science-related fields (Aikenhead & Michell, 2011). Students' socio-cultural worldviews affect the way they learn and it is possible that African worldviews impact African students' way of learning (Nashon, 2004). A detailed description of the differences between Western science and African worldviews will be provided later in the chapter. In an attempt to articulate the challenges posed by the gap existing between physical science subjects taught in school and African children's worldviews and real-life experiences, the first section of this chapter describes a general overview of the physical science subjects taught in school, followed by a discussion of the challenges of learning science in general, and physical science, more specifically. Next, an analysis of the nature of non-Western science is discussed and finally some ideas will be suggested for contextualizing physical science in order to make it more

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relevant and applicable to the African context. In this chapter, the phrase "traditional African worldviews" is used to refer to the general way the original peoples of the African continent made sense of their physical environment and how they interpreted and explained natural phenomena.

PHYSICAL SCIENCE SUBJECTS TAUGHT IN SCHOOL

Physical science comprises of natural science disciplines concerned with the study of inanimate natural objects, for example, physics, chemistry and astronomy taught in secondary schools. Unlike the study of life sciences that focus on the study of living things and life processes that are more practical in nature, physical sciences are more challenging for many students because they involve theoretical concepts that are not tangible. Physics and chemistry, for example, embody a problem-solving character that uses mathematical knowledge as a tool to explain how non-living phenomena work, and students need to have strong mathematical skills in order to be successful in these subjects. Astronomy, on the other hand, involves a study of the universe, including the earth's position and its movement in relation to other bodies in space.

Astronomy is challenging for students because the scientific explanations of the position and movement of bodies in space is contrary to what one experiences. Despite technological advances that have provided evidence of the existence of other bodies in space and the nature of the planet Earth, the fact that students cannot see outside of their universe makes it hard for them to reconcile scientific facts with their experiences. Science education researchers have uncovered some persistent misconceptions related to scientific explanations of the movement of the Earth such as seasonal changes, phases of the moon and movement of meteors (Barrier, 2010). Some examples of the misconceptions include; a) the earth is the center of the universe (planets, sun and moon revolve around the earth); b) the earth is the largest object in the solar system; c) phases of the moon are caused by shadows cast on its surface by other objects in the solar system; d) we experience seasons because of the earth's changing distance from the sun (closer in the summer, further in the winter; and e) meteors are falling stars. Misconceptions found among university students parallel those of many people without special training in science (Favia, Comins, & Thorpe, 2013). These misconceptions are acquired from life experiences, students' own reasoning and media representations (Libarkin, Asghar, Crockett, & Sadler, 2011). This poses challenges for most students as they try to reconcile their experiences and beliefs with science concepts they learn in school. The next section examines the challenges that students experience in learning Western physical science taught in school.

SCIENCE LEARNING CHALLENGES AMONG NON-WESTERN STUDENTS

Science subjects taught in school have been found to be alienating for most students, fewer students choose to specialize in science at college level, and even fewer

students go on to pursue STEM- (science, technology, engineering and mathematics) related careers (Business-Higher Education Forum, 2010). Science educators have grappled with this challenge for a long time and the methods used to teach science have been identified as a stumbling block for most learners. Science has traditionally been taught through rote memorization of facts from a textbook. In addition, the scientific terms that are used in science textbooks do not have direct meaning in the everyday language of students, and most students do not find the relevance of science facts to their daily lives (Gallagher, 2006).

In order to be competent in science, students must be able to "talk the teachers' talk" (Lemke, 1990) which does not necessarily translate to application of the scientific knowledge to real life. What this means is that memorizing the scientific jargon without understanding its application to real life does not lead to the desired outcome, which is the development of usable scientific knowledge. Costa (1995) points out that students are normally left to do their own accommodations as they attempt to "cross borders" and they emerge either as "potential scientists" or "outsiders" to the world of science. For potential scientists, crossing borders into school science is smooth and natural. Borders appear invisible. Those students who are unable to cross the border into school science become outsiders to the world of science.

The challenges confronting science learning have been found to be more pronounced among students who are from cultures whose worldviews are not Western. These include indigenous peoples from regions such as Africa, Asia, South America, North America, Australia and New Zealand (Aikenhead, 2011). Students from non-western cultures have different life experiences and cultural beliefs from those of their Western counterparts and they struggle to reconcile their preconceived ideas and cultural beliefs with the Western science presented in school. Ogawa (1986) observes that the way people perceive and explain phenomena differs due to their beliefs and experiences. Other studies have also revealed some general elements of the African's worldview, for example, that every cause and effect is human designed and executed by humans, and that the world to the African is full of life (Jegede, 1995; Coetzee & Roux, 1998; Lagoke, Jegede, & Oyebanji, 1997; Mudimbe, 1988).

Some theories about science learning among non-western students have been brought forward. For example, Jegede (1995) proposes the collateral learning theory to explain how students from non-western cultures harmonize the conflict resulting from a traditional worldview and that of western science. According to this theory, students will construct scientific concepts with minimal interference and interaction with their traditional beliefs/worldviews (related to a specific physical event). Jegede (1995) also suggests a continuum of collateral learning; in some cases, parallel collateral learning happens whereby the conflicting schemata from the two different worldviews do not interact at all and yet, in other cases, the conflicting schemata from the two worldviews consciously interact and the conflict is resolved in some manner. In-between there are cases where the schema from one worldview challenges the other worldview to an extent that permits the student to modify an

existing schema without radically restructuring their existing worldview. Students may survive school science by boxing off portions of their thought systems into scientific and aesthetic knowledge and these become separately and exclusively contained (Jegede, 1997).

On the other hand, Aikenhead (1996) considers African students' experiences of learning Western science as "crossing boarders" from the sub-culture associated with their own socio-cultural environments to the sub-cultures of Western science. Aikenhead (2006) also suggests that a majority of non-Western students prefer to understand the world through other worldviews, such as aesthetic, religious or economically pragmatic ones (Cobern, 2000). Such students do not relate easily to Western science and they often experience science as a foreign culture. According to Aikenhead and Michell (2011), students who do not relate to science can become frustrated and alienated from science:

> Their intuitive or subconscious reaction may be so subtle that science teachers seldom detect it and many science teachers may not be aware of their students' adverse feelings towards school science unless the teachers are acquainted with students' worldviews that differ so much from scientific worldviews. (p. 1)

Several educators have written about the need to broaden the science curriculum to include traditional knowledge from different indigenous cultures. Some examples include voices that have advocated for traditional African knowledge (Ogunniyi, Jegede, Ogawa, Yandile, & Oladele, 1995; Jegede, 1995, 1997; Ogawa, 1998; Ogunniyi, 2007; Ogunniyi & Hewson, 2008) and indigenous Aboriginal knowledge (Roberts, 1998; Michie, 1999; Cobern & Aikenhead, 1998; Aikenhead, 2006, 2011). Questioning the nature of science and whose knowledge is valued has led to some education departments taking action to integrate indigenous knowledge into the school curriculum. This move has also been made possible by the indigenous peoples from different parts of the world who have been asserting for their human rights during the last two decades. Examples include the Aoteraroa of New Zealand, who influenced the translation of the New Zealand science curriculum into Maori by Maori elders in 1993; the Australian National curriculum that supports indigenous science; the South African Department of Education integration of indigenous knowledge in the school curriculum in 2002; and in Canada several ministries and departments of education recognize indigenous ways of knowing nature as fundamental content in school science (Aikenhead, 2011). In support of the integration of indigenous knowledge into the New Zealand school curriculum, Michie (1999) argues that it is impossible to capture all indigenous experiences from different cultures, even if one possesses the experiences. Michie (1999) thus emphasized the danger of uncritically transmitting knowledge that has been created from a different culture. This is because different ways of knowing (metaphysics) come from different ways of thinking (epistemology):

> As a western person I realize that I may be able to know what an indigenous person knows but not necessarily think as they think. Without both metaphysics and epistemology I am unable to function from their worldview. (Michie, 1999, p. 1)

TRADITIONAL AFRICAN BELIEFS

Making reference to African children is neither to claim Africa as one culture nor to lump all Africans as having one belief system. Africa is a continent of 54 sovereign states, and within each state are different ethnic communities who are defined by their languages, dialects and belief systems. No single group in Africa can take account of all the many variations in belief systems, hence, the phrase *traditional African belief* is used in the context of a multitude of belief systems. According to Forde (1968), there are some general features that form the basis of different traditional African belief systems and these include myths of the origin of a people, of the natural resources that sustain livelihoods, of their cultural equipment and of social institutions and expression. These myths express and sustain attitudes towards extra-human forces that are believed to control or intervene among them. It is however important to note that cultural values and beliefs are not static, and in Africa most belief systems have been influenced by Western values through colonization and globalization.

Cultural beliefs are tightly held and, although changes in cultural values may tend to mask these beliefs, only through deep interrogation can the strongly held beliefs be unearthed. Examples can be found in studies that have shown deeply held beliefs among students and science teachers (Onwu et al., 2006). Findings from this study show that although students demonstrated an understanding of science, they still held traditional beliefs about causes of lightning and traditional medicine. Other examples of traditional beliefs about our universe include the Kikuyu of Eastern Africa's belief that God controls the rain and the thunder, with which he punishes evildoers when necessary. Similarly, the Shona of Southern Africa believe that the ancestral spirits control the rain and that droughts are a sign that the ancestors are not happy and that lightning is a weapon used by African psychics to attack one's enemy. Jegede (1997) refers to these worldviews as African science. The next section focuses on traditional African science and Western science taught in school.

INTERROGATING INDIGENOUS AFRICAN SCIENCE AND WESTERN SCIENCE

Traditional African science refers to the processes and thinking patterns inherent in the way Africans make sense of their world (Jegede, 1997). This has also been referred to as African worldviews or African ways of knowing. What justifies the traditional African ways of making sense of their world as a science is the fact that it involves observation of phenomena, identifying patterns and finding explanations

for why something would happen in a certain way. This process is similar to the process of Western science, but the two differ in the sense that Western science relies on both experimentation and observation to reach at certain explanations and conclusions. For example, the two sciences have different explanations for observations of phenomena such as the moon going through different phases each month and the cycles repeating in exactly the same way over and over, or seasons changing, and the pattern repeating itself. Western science uses highly advanced instruments such as telescopes to observe and record the movement of the moon around the earth and the explanations are simply deduced from these observations.

Understanding the differences between traditional African science and Western science can help build an appreciation of the ideas that normally get lost in translation from one knowledge system to the other. African students come to school with preconceptions about how the world works either based on their daily experiences and what they learn from those around them. Meaningful learning only happens if students can make connections between the new information and their prior knowledge (Hailikari, Katajavuori, & Lindblom-Ylanne, 2008). For African students, the preconceived ideas they bring comprise of their everyday experiences as well as some strongly held beliefs or worldviews that have been passed on from generation to generation. When doing science they make sense of the new knowledge by relating it to what they already know, and if what they know does not correspond to the explanations given in school, they may find it hard to translate the new content into meaningful knowledge.

Western and indigenous African physical sciences differ in ways that Jegede (1997) has illustrated in Table 1 below.

Table 1. Traditional African science and Western science

Traditional African science	*Western science*
Anthropomorphic	Mechanistic
Monistic-vitalistic and metaphysical	Seeks empirical laws, principles, generalizations and theories
Based on Cosmology and interwoven with traditional religion	Public property, divorced from religion
Orally communicated	Primarily documented via print
The elders' repository of knowledge is truth not to be challenged	Truth is tentative and challengeable by all
Learning is a communal activity	Learning is an individual enterprise

Source: Jegede (1997, p. 7)

The two sciences differ in terms of process of knowledge creation, knowledge transmission and ownership of knowledge. Traditional African science ascribes human qualities to both animate and inanimate objects and mingles the material and

non-material worlds, the physical and metaphysical. On the other hand, Western science subscribes to Cartesian dualism and views nature or the material world as comprised of inert matter and energy. Whereas Western science seeks to ascribe laws and principles to natural processes such as gravity, traditional African science does not (Aikenhead & Michell, 2011). However, African science shows understanding of reality in a much deeper sense and nature is viewed simultaneously as material and sacred. Spirituality is pervasive in indigenous ways of knowing nature (Aikenhead & Michell, 2011). The material world is imbued with spirituality. For example, the Lele of Kasai in the Congo associates natural objects with the spiritual world.

> Certain animals and plants show signs that they are associated with the spirits in a particularly close way; the pig, as I have said, because he frequents the sources of streams. The bush bucks, because, like the spirits, they sleep all day and move at night, are spirit animals…. The banana, for example, is a plant of the spirits because, when it has been cut down, it does not die, as would a palm, but sprouts and lives again. (Forde, 1968, p. 10)

Traditional African knowledge is orally communicated and passed on verbally as opposed to Western science that is documented via print media. Because of this nature of traditional African science, it is the elders who are the repositories of knowledge that they pass on down to younger generations. On the other hand, Western science is subjective, tentative and ever changing. Understanding traditional African worldviews is a moral act (Aikenhead & Michell, 2011) as well as an intellectual achievement for African science teachers. This can help their efforts to bridge Western scientific knowledge and traditional African worldviews so that science content becomes meaningful and applicable to the students' own lives. Students can become aware of powerful symbolic metaphors, such as *the family bull* (a practice of the Shona where a bull was chosen to represent the ancestral spirit responsible for watching over the village) that connect to traditional African spirituality without discussing or accepting that spirituality.

CONTEXTUALIZING SCIENCE LEARNING FOR THE AFRICAN CHILD: THE SEITT PROJECT

At the Sixth Annual Conference of the *Southern African Association for Research in Mathematics, Science and Technology Education* (SAARMSTE) held at the University of Zimbabwe in 1999, science educators unanimously agreed that science was being taught out of context. This was viewed as one of the reasons Africa had been failing to produce the critical mass of scientists needed to spearhead development of locally relevant technologies that would lead to self-reliance and prosperity. In an effort to improve the teaching of science in Zimbabwean high schools, the University of Zimbabwe secured funding from the Dutch government in 1990 for a *Science Education In-service Teacher Training* (SEITT) project. The project was designed to provide in-service training to high school science teacher-

leaders with a focus on innovative teaching strategies that they would in turn teach to their counterparts. The second phase of this project involved writing workshops aimed at training resource teachers to write their own contextualized science curriculum materials. Writing contextualized curriculum materials for a particular topic in science involved identifying familiar everyday examples that could be used to describe the main science concepts in the topic.

Mushayikwa and Lubben (2009) argue that engaging science teachers in the process of developing contextualized curriculum materials is a necessary component of self-directed professional development, as it enables teachers to tackle challenges relating to both their classroom and professional efficacy needs. For example, in the study they noticed that successful contextualization resulted in more confidence, greater authority and leadership and professional efficacy, greater adaptation of content and more creative use of resources in terms of classroom efficacy.

Similarly, a study of the practices of Zimbabwean secondary science teachers who had participated in the SEITT project revealed that the teachers were more knowledgeable and were confident in applying scientific principles to local contexts and examples (Gwekwerere, Mushayikwa, & Manokore, 2014). The phrase 'contextualized science instruction' is used to emphasize the need for science instruction that draws from relevant indigenous and everyday knowledge and experiences that the learner brings to the classroom. Contextualizing science education has therefore pre-occupied science educators' efforts in the Southern African region since then (Onwu et al., 2006; Ogunniyi, 2007; Mushayikwa & Lubben, 2009).

Teachers in developing countries are best placed to contextualize scientific knowledge within their local contexts in order to make science meaningful to students. Contextualism is Deweyan or idea-based social constructivism, which accepts the fact that understandings emerge at the boundary of the person and the environment; are situated in context; and might change as context changes over time (Schaffer, 2004). Epistemological contextualism has evolved primarily as a response to views that maintain that we have no knowledge of the world around us (Schaffer, 2004). When applied to science learning, contextualism entails using examples and applications of scientific principles to situations that are familiar to students' lived experiences and worldviews. When taught this way, the principles of science are more easily applicable and meaningful to the students. This way of thinking about science teaching is based on the understanding that scientific knowledge is socially constructed within the Western culture (Lemke, 2001), hence there is need to create opportunities for African teachers and students to construct science knowledge that is meaningful within their own cultural context and experiences. In the following section, one teacher's success story in contextualizing physics and chemistry content after participating in the SEITT materials writing workshop is revealed. The data is from an interview that was conducted as part of a larger study that evaluated the effectiveness of the SEITT project (Gwekwerere et al., 2014).

CONTEXTUALIZED TEACHING OF PHYSICAL SCIENCE: CASPER'S STORY

To show the possibilities of how physical science subjects can be contextualized to make them more relevant and applicable to African students, the story of Casper, a Zimbabwean high school physics and chemistry teacher who was one of the SEITT participants, is presented. After completing high school in Zimbabwe in the early 1980s with a concentration in the physical sciences, Casper was awarded a scholarship to study in Cuba. He was part of a group of Zimbabwean youth who went to study for their Licentiate teaching diploma in Cuba, soon after Zimbabwe gained independence in 1980.

At the time this study was conducted, Casper was a physics and chemistry teacher at a rural high school in the North-eastern part of Zimbabwe. Casper said that he had chosen the teaching profession because he felt that he had a duty to inspire young people and he wanted to make an impact on their lives. His favorite subject in school was science, which he clearly remembered learning through rote memorization of facts. When he started teaching, Casper felt well-prepared for the job and he credited his preparedness to the training he received while studying in Cuba, where he got lots of practical experiences and was exposed to student-centred teaching methods that focused on application of science to real-life situations. His experiences in Cuba were totally different from his own experiences as a student in Zimbabwe and the teaching situation he came back to after his training. Casper was motivated to enroll in the SEITT program mainly because of the prospect of writing his own contextualized materials that directly related to students' everyday experiences, which is something he had seen teachers in Cuba do.

Casper described his experiences of writing contextualized physics and chemistry teaching materials for high school science as a success story. He gave the following example of the local context he uses while teaching the physics topic of waves:

> One of my favorite contexts when introducing the concept of waves to rural students is to ask kids if they have ever gone fishing. I would start by saying "Imagine you have gone fishing with grandfather and as grandpa waits patiently for a fish to come by, you throw a stone into the water." I ask students to describe what they see happening to the water and the floater on the fishing line. I then use the students' responses to introduce to them that the movement of the water and the floater moving up and down is because you have created a wave. I go on to tell them that the movement they see is not due to movement of molecules but its energy being transmitted (Casper's story).

Casper mentioned that his school did not have a ripple tank so they could not conduct experiments on waves. He reported that using familiar examples of everyday technologies and practices that students are familiar with help students to visualize the waves they have seen and they could easily make a connection between their own life situations and the physics concepts. The fishing example used by Casper helps students to visualize their prior experience of seeing waves in a river or dam

and connect this to the theoretical knowledge of how waves are formed, their nature and characteristics. This removes the abstractness of the concept of waves which may result when the wave is presented as a single wavy line in textbooks. Textbooks often depict waves as wavy lines and the practical application suggested is using a ripple tank to show students what waves look like. Since the ripple tank does not represent anything close to students' experiences in real life, this practical experiment just remains one of the classroom knowledge examples that never translate to real meaningful understanding. This is knowledge that becomes boxed off as classroom knowledge, compared to the concrete example of waves that students have seen, and continue to see, in rivers or dams surrounding them. The ripple tank, on its own, does not help students to see science patterns that exist in nature.

Casper also gave an example of contextualizing chemistry lessons on chemical reactions by using students' lived examples as demonstrated in the following quote:

> One example of a topic I have contextualized is about the rates of chemical reaction using ripening fruits, milk fermentation and burning paper. I ask students to describe these processes and how long they take. Then introduce the concepts of chemical and physical reactions as well as reversible and irreversible reactions; the fact that once a fruit is ripened it will not be unripe and that burned paper cannot change back helps to clarify the concepts. I also use examples of dissolving substances in water and how we can get back the sugar by drying up the water (Casper's story).

These examples are different from the way chemical reactions are presented in science textbooks where only chemical names are used and chemical reactions are represented by symbols and arrows. Casper also added that examples used in textbooks normally refer to industrial or commercial processes that students may never encounter in their lives. Casper emphasized the fact that he uses examples that his students have experienced whether they grew up in the city or in the rural areas. Zimbabwe is a tropical country where different fruit trees grow and students in rural areas are familiar with fruits that grow in the wild. Milk fermentation is also a process that most students would be familiar with as this is a traditional practice especially in rural areas. As Casper noted, using local examples familiar to students promoted understanding and helped to address misconceptions that normally result from the disconnection between the students' real-life experiences and the way science concepts are depicted in science textbooks either as theoretical concepts or using examples that are foreign to students. Casper articulated the power of contextualized teaching in the following way:

> The contextualized method of teaching really worked because the students themselves have seen the change. Performance has improved and the syllabus is still completed. This way we are trying to remove some misconceptions. We have identified some misconceptions and we have come up with a way of getting rid of these misconceptions. Students have developed a positive

> attitude towards the subject. The program introduced to us a way of making science "relevant, convenient and user-friendly" to the students. We bring the science knowledge close to the student. The student is able to understand the practicality of certain concepts that used to be theoretical and abstract (Casper's story).

Contextualizing science helped Casper and other teachers to demystify science as a difficult subject and made it more accessible to their students. It made science more practical and less abstract, as students got actively involved in developing an understanding based on what they know, what they see and the way they perceive their environment. The importance of contextualizing science materials for Indigenous African children as illustrated by Casper's story is undoubted. Using examples that students know gives them a sense that science is worth knowing in real life; it shows how scientific principles are equally relevant in the traditional African ways of knowing and ways of living.

Casper's story shows us the importance of equipping teachers with skills and knowledge to contextualize science teaching and enable them to exercise agency (Vongalis-Maclow, 2006) in their own practice as well as in supporting their peers. After going through the SEITT training program, Casper went beyond merely using local examples in his teaching. He wrote contextualized physics and chemistry laboratory manuals that incorporated local contexts and materials, and became a lead teacher who went on to train other teachers to contextualize their teaching (Gwekwerere et al., 2014). Perhaps the most 'intuitive' and instructive definition is "agency as the ability to influence one's life" (Kristiansen, 2014, p. 2). Agency, as defined by Archer (1984), is composed of three interconnected aspects; namely, obligation, authority and autonomy. What is critical in helping teachers exercise their agency is to give them the authority and autonomy to write their own materials and contextualize their teaching in order to ensure that the examples used are context specific. The rural contexts in Africa are different from the city contexts, therefore teachers have the obligation not to assume that one set of examples can be relevant for all African learners. Teachers can feel empowered when they realize that they are capable of developing their own contextualized teaching materials that are relevant for their students instead of reciting examples from textbooks that they themselves may not be familiar with. The SEITT program that Casper went through provided a viable in-service teacher professional development model that can help indigenous African teachers to make science more meaningful and relevant for the African child.

Contextualizing physical science can help African children realize the application of concepts and laws such as levers in traditionally made implements such as fishing lines, ploughing implements, and hand axes and other implements used for digging. Once they develop an understanding of how scientific principles apply to the way these mechanisms work, they can be able to think of ways of improving the available technologies. Traditionally, African technocrats, such as village blacksmiths and carpenters who never went to school, invented both simple and complicated

machines that helped to make work easy. Examples include ox-drawn wooden ploughs, wooden pillows, and wooden carts. However, some of these technologies were never improved upon but were replaced by factory-made implements that were designed elsewhere.

One of the few examples that still stand today is Great Zimbabwe, which has been standing for more than five centuries. A study of the physics and mathematical principles that went into the construction of these structures can be a great asset in the African physical science curriculum. Great Zimbabwe can be used as a typical example in the study of principles such as gravity and the stability of structures, solid-state physics, material science, and Newton's laws of motion (action-reaction forces, equilibrium, balances and unbalanced forces). High school students can visit these structures and spend a day taking measurements and making calculations to help them understand how the structures were made strong and stable. This can help students to appreciate the traditional African technologies and their relationship to Western physical science content.

CONCLUSION

This chapter discussed the nature of physical science subjects taught in school and the challenges faced by African students who fail to see the connection between school science and their real life experiences. The chapter focused on physical science subjects taught in school because these subjects promote the development of scientific knowledge that is needed for the development of technologies that can lead to more sustainable economies in Africa. As seen from this chapter, African children, like their non-western counterparts, struggle to see the connections between the physical science they learn in school and their real-life experiences. Bringing in real-life experiences in the classroom enables the students not only to see how the concepts and laws of physical science apply to their lives, but it can also help to promote imagination, creativity and innovation. African teachers should be empowered by providing them with a postcolonial understanding of the nature of science and the difference between traditional African science and Western science. There is also the need to support African teachers to contextualize physical science subjects using local examples and analogues that help to bring the science to life and make it meaningful for their students.

REFERENCES

Aikenhead, G. S. (1996). Science education: Boarder crossing into the sub-culture of science. *Studies in Science Education*, *27*, 1–52.

Aikenhead, G. S. (2006). *Science education for everyday life: Evidence-based practice.* New York, NY: Teachers' College Press.

Aikenhead, G. S., & Michell, H. (2011). *Bridging cultures: Indigenous and scientific ways of knowing nature*. Toronto: Pearson Canada Inc.

Archer, M. S. (1984). *Social origins of educational systems.* London: Sage.

Barrier, R. M. (2010). Astronomical misconceptions. *Physics Teaching*, *48*, 319. Retrieved June 14, 2010, from http://dx.doi.org/10.1119/1.3393064

Business-Higher Education Forum. (2010). *Increasing the number of STEM graduates: Insights from the U.S. STEM Education Modeling Project*. Washington, DC: Author. Retrieved May 6, 2014, from www.bhef.com/sites/g/files/g829556/f/report_2010_increasing_the_number_of_stem_grads.pdf

Cobern, W. W., & Aikenhead, G. S. (1998). Cultural aspects of learning science. In B. J. Fraser & K. G. Tobin (Eds.), *International handbook of science education* (pp. 39–52). Dordrecht: Kluwer.

Cobern, W. W. (2000). The nature of science and the role of knowledge and belief. *Science and Education, 9*(3), 219–246.

Costa, V. B. (1995). When science is "another world": Relationships between worlds of family friends, school and science. *Science Education, 79*(3), 313–333.

Favia, A., Comins, N. F., & Thorpe, G. L. (2013). *The elements of item response theory and its framework in analyzing introductory astronomy college student misconceptions. I. galaxies*. Ithaca, NY: Cornell University Library. Retrived April 27, 2014, from http://arxiv.org/abs/1206.2302

Forde, D. (1968). *African worlds: Studies in the cosmological ideas and social values of African peoples*. London: Oxford University Press.

Gallagher, J. J. (2006). *Teaching science for understanding: A practical guide for middle school and high school teachers*. London: Pearson Merrill Prentice Hall.

Gwekwerere, Y., Mushayikwa, E., & Manokore, V. (2014). Empowering teachers to become change agents through the Science Education In-service Teacher Training Project in Zimbabwe. *Canadian and International Education Journal, 42*(2), Article 3.

Hailikari, T., Katajavuori, N., & Lindblom-Ylanne, S. (2008). The relevance of prior knowledge in learning and instructional design. *American Journal of Pharmaceutical Education*, *72*(5), 1–8.

Jegede, O. J. (1995). Collateral learning and the eco-cultural paradigm in science and mathematics education in South Africa. *Studies in Science Education, 25*, 97–137.

Jegede, O. J. (1997). School science and the development of scientific culture: A review of contemporary science education in Africa. *International Journal of Science Education*, *19*(1), 1–20.

Jegede, O. J., & Aikenhead, G. S. (1999). Transcending cultural borders: Implications for science teaching. *Journal of Science and Technology Education*, *17*(1), 45–66.

Lagoke, B. A., Jegede, O. J., & Oyebanji, P. K. (1997). Towards an elimination of the gender gulf in science concept attainment through the use of environmental analogues. *International Journal of Science Education*, *19*(4), 365–380.

Lemke, J. L. (1990). *Talking science: Language, learning, and values*. Norwood, NJ: Ablex Publishing.

Lemke, J. K. (2001). Articulating communities: Sociocultural perspectives on science education. *Journal of Research in Science Teaching*, *38*(3), 296–316.

Libarkin, J. C., Asghar, A., Crockett, C., & Sadler, P. (2011). Invisible misconceptions: Student understanding of ultraviolet and infrared radiation. *Astronomy Education Review*, *10*(1), 1–5.

Kristiansen, M. H. (2014). *Agency as an empirical concept. An assessment of theory and operationalization* (Working Paper No. 2014/9). The Hague, The Netherlands: Netherlands Interdisciplinary Demographic Institute.

Michie, M. (1999, December 13–16). *Where are indigenous people and their knowledge in the reforming of learning, curriculum and pedagogy?* Fifth UNESCO-ACEID international conference Reforming learning, curriculum and pedagogy: Innovative visions for the new century, Bangkok, Thailand. Retrieved May 2, 2014, from http://members.ozemail.com.au/~mmichie/aceid.html

Mudimbe, V. Y. (1998). *The invention of Africa: Gnosis philosophy and order of knowledge*. London: James Currey.

Mushayikwa, E., & Lubben, F. (2009). Self-directed professional development: Hope for teachers working in deprived environments? *Teaching and Teacher Education*, *25*, 375–382.

Nashon, S. M. (2004). The nature of analogical explanations: High school physical science use in Kenya. *Research in Science Education*, *34*, 475–502.

Ogawa, M. (1986). Towards a new rationale of science education in a non-western society. *European Journal of Science Education*, *82*, 113–119.

Ogawa, M. (1998). A cultural history of science education in Japan: An Epic description. In W. W. Cobern (Ed.), *Socio-cultural perspectives on science education* (pp. 139–161). Dordrecht: Kluwer.

Ogunniyi, M. B. (2007). Teachers' stances and practical arguments regarding a science-indigenous knowledge curriculum: Part 1. *International Journal of Science Education*, *29*(8), 963–986.

Ogunniyi, M. B., & Hewson, M. G. (2008). Effects of an argumentation-based course on teachers' disposition towards a science-indigenous knowledge curriculum. *International Journal of Environmental & Science Education*, *3*(4), 159–177.

Ogunniyi, M. B., Jegede, O. J., Ogawa, M., Yandile, C. D., & Oladele, F. K. (1995). Nature of worldview presuppositions among science teachers in Botswana, Indonesia, Japan, Nigeria, and the Philippines. *Journal of Research in Science Teaching*, *32*, 817–831.

Onwu, G., Holtman, L., Vurumuku, E., Ogunniyi, M., Fakudze, C., & Langenhoven, K. R. (2006, January 10–13). *Teachers' knowledge of science and indigenous knowledge and views on the proposed integration of the two knowledge systems in the classroom*. Proceedings of the 14th Annual Meeting of the Southern African Association for Research in Mathematics, Science and Technology Education, University of Pretoria, South Africa.

Roberts, M. (1998). Indigenous knowledge and Western science: Perspectives from the Pacific. In D. Hodson (Ed.), *Science and technology education and ethnicity: An Aotearoa/New Zealand perspective* (pp. 59–75). Wellington: The Royal Society of New Zealand.

Schaffer, J. (2004). From contextualism to contrastivism. *Philosophical Studies*, *119*(1–2), 73–104.

Vongalis-Macrow, A. (2006). Displaced agency: The obfuscation of teachers in globalized education policy. In W. D. Bokhorst-Heng, M. D. Osborne, & K. Lee (Eds.), *Redesigning pedagogy: Reflections on theory and praxis* (pp. 59–73). Rotterdam, The Netherlands: Sense Publishers.

EDWARD SHIZHA

4. AFRICAN INDIGENOUS PERSPECTIVES ON TECHNOLOGY

INTRODUCTION

Contemporary African societies bear the imprint of the legacy of colonialism but they are also marked both by their pre-colonial heritage and their different post-colonial experiences. The way Africa is known today is a reflection of the political, economic and historical intrusions and constructions of its societies that resulted from colonial contact with Europeans in the 18th and 19th centuries. Africa's development, particularly in science and technology, is judged from the perspectives of its former colonizers. There is a tendency to look at Africa as if it never possessed any science and technology before Europeans set foot on the continent. Colonial thought on indigenous African communities and societies were eminently used to reconstruct indigenous peoples as homogenous and unchanging (Brownlie, 2005).

Pre-colonial African societies were not homogenous. There were [are] marked contrasts between the Ethiopian empire and the hunting groups of the Mbuti in the Congo or between empires of the Western Sudan and the Khoisan hunter-gatherers of the Kalahari Desert. Indeed, there were striking contrasts within any given geographical area. The Ethiopian empire embraced literate feudal Amharic noblemen as well as Kaffa cultivators and Galla pastoralists. The empires of the Western Sudan had sophisticated, educated Mandinga townspeople, small communities of Bozo fishers and nomadic Fulani herders. Even among clans and lineages that appear roughly similar, there were considerable differences. These communities had their form of civilization and designed technology that was appropriate to their economic activities. What constitutes 'civilization' is cultural and political.

Africa created its own indigenous technology using its own scientific knowledge. Each African society, from the East to the West and from the North to South, had its own scientific knowledge, which was put into practice and worked for the good of its people. The tools with which societies worked and the manner in which they organized their labour are both important indices of social and technological development. This chapter is based on arguments that support perspectives/propositions that pre-colonial Africa had scientific and technological tools that were designed and used to enhance the quality of lives of indigenous people in African communities. There were traditional skills and techniques that were used in the production of arts and crafts, blacksmithing, iron smelting, carding and weaving, and brewing, among others that summed up indigenous technology in Africa.

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COLONIAL DISRUPTIONS OF PRE-COLONIAL AFRICAN DEVELOPMENT

Gennaioli and Rainer (2005) have observed that historians have documented that African pre-colonial institutions shaped modernization in Africa due to their continuity in the periphery, especially in rural areas and that such continuity dates back to the end of the 19th century, when the massive European colonization of Africa began. Citing historical accounts of White (1959) in Angola; Abubakar (1980) in Nigeria; Schapera (1970) in Botswana; Ashton (1967) in Lesotho; Boone (2003) in West Africa; and Mamdani (1996) in Sub-Saharan Africa, Gennaioli and Rainer (2005) conclude more generally that pre-colonial Africa was disrupted from its course of development but continued to do so in spite of the disruptions. The technology was relevant in organizing labour and in the production of goods, and it was appropriate to the needs of each African society.

Communal labour was entered into by cross-sections of the community to make work more efficient. While the organization of labour might have increased production, the principal change in the productive forces was that which comprised new techniques—both tools and skills—in dealing with the environment and new plant and animal species. Unfortunately, European colonization interfered with and destroyed the social relationships of production and the development of indigenous technological advancement that were in place. Basil Davidson (1992) argues that colonialism prevented the potential for the natural maturing of pre-colonial African institutions. These postcolonial sentiments are also expressed by Onipede (2010) who states the following about the effects of colonialism in Nigeria:

> More importantly, the introduction of colonial rule and by extension 'imperialism' laid the foundation for Nigeria's industrial underdevelopment. Because by nature imperialism is fortuitous, transferring to the metropolitan states the wealth of the underdeveloped nations, thereby undermining them through capital and human exploitation, colonialism and contemporary neo-colonialism. Indeed, the historical and current technology underdevelopment of the country could not be explained without reference to imperialism and European economic domination. The imperialist domination of Nigeria and its underdevelopment is a total process involving all facets of national life. (p. 86)

While Onipede's statement above focuses on the interruption of technological development in Nigeria, the impact of colonization on technological advancement and its effect on disrupting the economic lives of indigenous people was felt across and in all African societies. Post-colonial Africa suffered from the deskilling and disturbances in the course of development, heinously effected by colonial regimes. The consequences of colonialism and imperialism in corrupting indigenous development and technologies in Africa were previously discussed at length in Walter Rodney's (1982) classic *How Europe Underdeveloped Africa*, which lucidly and critically analyzes the relationship between Europe's economic development and Africa's underdevelopment.

European settlers in Africa considered indigenous people to be passive and receptive so that their [Africans] worldviews could be remodified and readjusted to accept Eurocentric ideas and perspectives of life and development. In addition, colonial assumptions were that European technologies could be used to control and remodel indigenous people to the liking of the colonial 'master' (Rodney cited in Shizha, 2008). European misconstruction and misrepresentation of indigenous African people are aptly expressed by DePasse (2008) who argues that:

> European colonizers, explorers, missionaries, and the colonial centre's representatives assumed the power to classify, name, value and/or devalue southern people, cultures, landscapes, flora and fauna, and natural resources, often by relying on previous knowledge, prejudgments, wistful thinking, conventional wisdom, and even fabrication. (p. 16)

These Eurocentric biases, and subsequent classifications tended to be severely flawed (Amin, 1989). The purpose of the misconstructions was to create and perpetuate asymmetrical relations between themselves and the colonized (Adjei & Dei, 2008). The colonizers were basing their control of indigenous people and their indigenous constructions of reality on the basis that, as communities struggle to deal with their "ever changing set of conditions and problems" (Agrawal, 1995, p. 5), their understanding of social realities also undergoes constant modification to suit their complex relations with nature, land, culture and society (Adjei & Dei, 2008). Conclusively, colonization was a fatal project of conquest of the body, mind and the land.

LOCATION-SPECIFIC, CULTURALLY APPROPRIATE TECHNOLOGY

Technology development is generally regarded as a catalyst for socio-cultural growth, including changes in the material culture of a given people. It offers among other things, the necessary support for change in all the major sectors of the economy, most especially in agricultural and industrial sectors (Onipede, 2010). The definitions of technology are multifaceted as they depend on who defines the term and the social and cultural context in which the definition is applied, and the extent of the application to which the technology has been purposely created. Hornby (2002) describes technology as the scientific knowledge that is used in practical ways, especially in the designing of new machines, machineries and equipment. On the other hand, Titanyi (1985) cited in Onipede (2010) includes the social and cultural transformation that results from technological creation. For Titanyi, science and technology represent power instruments of change which can assist in the economic, social and cultural development of people. In other words, technology and science are related and have the effect of engineering people's socio-cultural lives and economic activities. Olaoye (1992) interprets technology to mean the transformation of a theoretical idea to a practical skill in order to produce the objects of one's need. Expressed differently, technology is created from ideas and skills that

are generated and consummated into usable products. Consequently, "technology development is the transformation of ideas to practical skills, which are concerned with the production and transformation of raw materials into finished goods" (Onipede, 2010, p. 85).

Technology has to be appropriate to the community that it serves. There is widespread agreement that technology is more effective when it is 'culturally appropriate' for the populations it serves, but according to Brach and Fraser (2000), little is known about how best to achieve this cultural appropriateness. However, in pre-colonial Africa, cultural appropriateness was not a problematic issue, as the technology was location-specific and targeted at exploiting local resources or using skills that enriched the local people's living conditions. Cultural appropriateness refers to the ability of the technology to meet and satisfy the socio-cultural needs of the local people. These needs relate to ways of getting food, the tools required to carry out everyday economic activities and the improvement in the quality of people's lives. Thus, the usefulness of technology is symbiotically related to the cultural and social demands for social development. By and large, the key to appropriate technology is its contextual relevance, specificity and locatedness. In pre-colonial Africa, indigenous technology was widespread in all societies and was recognized "as a valuable science that deserves[d] recognition" (Shizha, 2011, p. 16). Its recognition was based on how it was used by people and how it met their socio-cultural and socio-economic needs. A society develops economically as its members increase jointly their capacity for dealing with the environment; this capacity for dealing with the environment is dependent on the extent to which they understand the laws of nature (science), on the extent to which they put that understanding into practice by devising tools (technology), and on the manner in which work is organized (Rodney, 1982).

Schoffeleers (1979) discusses the complex relationship between communities and their environment, and the various institutional mechanisms developed by these communities to manage natural resources. The management of the natural environment required skills and tools that were specifically relevant to the communities and societies. For example iron smelting in Southern Africa required designing tools that could be easily used by an ironsmith. The tools or technology were appropriate to the cultural environment and were designed with the intention of being usable by those members that resided in the community. Since forms of economic production were particularistic and communally owned, it was imperative that the tools for production were appropriate to a particular community.

PRE-COLONIAL TECHNOLOGY AND DEVELOPMENT

Development is an elusive concept that is difficult to define and is surrounded with ethnocentric connotations when it is defined from an outsider perspective. Development is associated with progress and the ability of the people to enjoy a better life than before. Technology development entails a process of mobilizing

resources and socio-cultural and harmonious integration of modern and traditional technologies organized and fitted into feasible projects designed for specific purpose (Onipede, 2010). In this context, therefore, all societies, whether pre-colonial or post-colonial, and even those that were/have never been colonized, have the capability to make progress and change the quality of people's lives. Pre-colonial African societies recorded tremendous and overwhelming progress. For example, the process of textile weaving, spinning and dyeing, had been a well-established occupation in pre-colonial Nigeria (Onimode, 1982). The monumental structures at the Great Zimbabwe in Zimbabwe attest to the scientific and technological skills that were used by the Shona people. They are a unique testimony to the Bantu civilization of the Shona people between the 11th and 15th centuries. Great Zimbabwe shows skilful creativity and ingenuity; there was no cement that was used to join the rocks together to construct the walls and the conical tower in the centre of the walls.

It is apparent that pre-colonial Africa was not static but dynamic with skilful transformations taking place all over the continent. As Barua (2010) argues, indigenous knowledge and technology in pre-colonial times were "neither static nor frozen. [They were] socially dynamic and culturally appropriate … [and] practised in the local environment" (p. 63). All over Africa, we find evidence of how indigenous knowledges were utilized to develop tools for managing pre-colonial lives. Some of the evidence includes rock-art images that show the things that were most important to those who drew them and also the different lifestyles of different groups of people who lived in those locations. Particular examples of the complexity that some African societies achieved are given and discussed at length by numerous scholars. Whether in Ancient Egypt, Axum, Kush, the empires of Ghana, Mali, Songhai, and Kanem-Bornu, as well as Bunyoro-Kitara, Zimbabwe, Mutapa, Oyo, Benin, and Kongo, most pre-colonial African societies developed appropriate technologies and ways of life that catered to the needs of their people.

The development of technology was viewed as a communal necessity and enterprise. Societies and communities had *de facto* sovereignty to carry out their day-to-day activities and make real-life decisions (Belanger, 2010). Unlike today, where development programs are determined by central government in some countries, in the pre-colonial era, communities were organized by their leaders and came together to decide what the communities needed and how to go about carrying out activities to meet these needs. At the same time, skilled people were identified and/or came up with creative ideas on tools that would be relevant to conducting the development activities. Development decisions reflected the goals of the whole community, not the goals and aspirations of individuals. At the community level, development would connote the application of learned skills that deliberately sought to eventually lead to community advancement through the harnessing of available human and natural resources (Abdi, 2003; Abdi & Guo, 2008). Traditional indigenous societies were not as conservative and inhibitive to development as generally assumed (DePasse, 2008). The truth about pre-colonial African societies is that they had indigenous knowledges that were not only "known for their resilience,

ability to describe, explain, predict and negotiate nature" (Shizha, 2010a, p. 28), but they were also acclaimed for their "trajectory of a movement from an abject past to a liberating present" (Ghosh, 2010, p. 37). Indigenous people had agency, voice and the power to decide their destiny without outside interference. Their lives were interdependent and embedded in their sovereignty and autonomy.

Indigenous knowledge systems were and have been prevalent in societies for thousands of years (Barua, 2010; Shizha, 2009). They are experiential and tend to address diverse and complex conditions of the society and environment for sustainable livelihoods. In pre-colonial Africa, it was the ability of the knowledge to address complex conditions that made it easy to translate and transform the knowledge into practical skills that were used to design new tools for sustainable livelihoods. The importance of indigenous knowledge in transforming people's livelihoods is noted by Haque (2010) when he cites Viergever (1999). Haque identifies three elements in indigenous knowledges, and these are; (i) the outcome of a dynamic system (*innovative talent of each indigenous people*); (ii) an indispensable part of the physical and social environment of traditional communities; and (iii) a collective well-being (p. 98). These three elements indicate that traditional or pre-colonial communities had people with innovative or creative talents that were utilized to create tools or technology to exploit the natural environment in a socially and culturally appropriate manner for the well-being of the community members. Technology was therefore not individualized and independent of the collective, but it was a community project for sustainable livelihoods and development. Several studies have been done on the traditional skills of pre-colonial Africa (see Bisson, 1990; Miller & Maggs, 1994; Shaw, Sinclair, Andah, & Okpoko, 1993; Pole, 1975), with evidence revealing the positive contribution of indigenous skills and techniques, particularly to the development and growth of various African communities before colonialism.

APPRENTICESHIP AND PARTICIPATORY KNOWLEDGE CONSTRUCTION

Learning and practice are the core components in developing both skills and tools for development. The learning of skills in the production of knowledge and technology is vital to community development. Evidence from history, anthropology and archaeology shows that pre-colonial communities and societies emphasized sharing and solidarity in the production of materials and goods. According to Durkheim (1933), traditional societies tended to promote mechanical solidarity because of the kinship ties that existed among the members. For Durkheim, mechanical solidarity refers to integration that is based on shared beliefs and sentiments. Societies of mechanical solidarity tend to be relatively small and organized around kinship affiliations. Social relations are regulated by the shared system of beliefs, what Durkheim called the *common conscience*. Consequently, to cement solidarity, communities taught their young ones, and any other member who wanted to learn, skills that enhanced the community's welfare. Collectivity was a pre-requirement

for community development and collective consciousness was the framework and basis for participation in social, economic and cultural processes that idealized and concretized the community's needs and aspirations. In this case, as pointed earlier in the discussion, cultural appropriateness was pertinent to the quality of technology produced.

In pre-colonial Africa, the learning of skills in the production of knowledge and tools for socio-economic development was a community activity based on the concept of *Ubuntu*—a "traditional African culture where brotherhood and collective responsibility are placed above the individual initiative and self-sufficiency, and where the group takes care of the individuals" (Shizha, 2009, p. 144). *Ubuntu*, which literally means humanness or humanity to others, is deemed to promote a sense of community and communality (Gianan, 2010). It is conceived as a philosophy emerging from an African culture, wherein it also becomes manifest that it is actually in dialogue with its own culture, including other cultures. *Ubuntu* is an accepted socialization effect that promotes a cultural collective way of life; it is a philosophy that is in dialogue with culture. This philosophy of mutuality in socio-economic life is in contrast to the Western or Eurocentric philosophy of social life that is based on individualism and competition (Shizha, 2006). Community and communality play an essential role in human consciousness and relationships and in *Ubuntu*. Community literally means togetherness, of existence; with oneness or unity; existing together as one (Gianan, 2010).

The magnitude of pre-colonial African societies' achievement is best understood by reflecting on the early history of human society and noting firstly, the progress from crude stone tools to the use of metals; secondly, the changeover from hunting and gathering wild fruit to the domestication of animals and the growing of food crops; and thirdly, the improvement in the character of work from being an individualistic activity towards an activity which assumes a social character through the participation of many. In African societies, members of the community who had skills to pass on to other members of the community encouraged participatory activities in skill training. This form of skill training is what could be considered as apprenticeship training in today's work-related learning. Pre-colonial African society was, like all societies, particularly the "traditional" ones, participatory and needed no training or initiation by outsiders or "professionals" (Rahnema, 1990). Participation assumed mutuality between the local community, the local trainers and the learners, an arrangement where all had the capacity and opportunity to participate fully (Chambers & Balanoff, 2009).

Community is closely tied to the concept of communality. *Ubuntu* gives birth to communality. According to Gianan (2010):

> Communality entails a shared experience of any human activity. This communality brings out the idea of Ubuntu as universal. Communality literally aims for the common, public good of human beings. Ubuntu is communal in the sense that it elicits unselfish, collective responsibility as against the selfish,

> irresponsible individuality that some thinkers, scientists or even cultures have been trying to perpetuate. (p. 90)

Community members through the principle of communality brought local ways of being, acting, and communicating to the social processes of creativity and production, thus building interconnecting social relations within the community. As reported by Shizha (2007), traditional African communities used their traditional ecological knowledge that includes physical science and related ethnotechnologies, social sciences, and humanities to develop knowledge transfer approaches. In support of this idea, Atte (1989) amply argues:

> In all those fields, each rural [community] group developed knowledge encompassing theory, concepts, interrelations, factual data and attributive information of a high degree of accuracy. Such knowledge is [was] so good that such societies have [had] been able to exploit them both for social organizations and productive endeavors to maintain the group. (p. 7)

Community knowledge and experiential knowledge were integrated into community apprenticeship programs which were collectively owned, and community participation in these skill development projects was vital to their success (Shizha, 2009). Indigenous knowledge was typically tied to and incarnated in specific social, cultural and economic activities within African traditional societies, and it was typically acquired by some form of participation in those activities (Semali, 1999). As Ngara (2007) points out, the basic structures of knowledge and skills brought into production during skill training and apprenticeship was collectively constructed and transmitted through a participatory and collectivist model of learning with a community focus. The learning of skills needed to produce required technology was based on personal observation within both the social and natural environment (Shizha, 2009).

CONVIVIALITY AND RECIPROCITY

Knowledge production and technological creativity have an overall impact on social relationships, which in many cases are based on conviviality and reciprocity as members cooperate and exchange ideas in the exploitation of resources and in production processes. Conversely, one can also argue that social relations of production and the maximization of productivity largely depend not only on communality but also on conviviality. Conviviality is the term that was coined by Ivan Illich to define a society that prefers the maximization of individual's creativity, imagination and energy to the maximization of outputs, where the latter usually leads to an industrial mode of production (Illich, 1973). In his 1971 critical discourse on education, *Deschooling Society* (Illich, 1971), Illich defines a convivial learning experience as one based on role swapping: teacher role alternates with learner role and vice versa, thereby emphasizing the concept of reciprocity as a key component to conviviality.

A convivial relationship existed between the elders and the younger generation in African traditional society. The relationship was noticeable in the teaching and training of the youth and even other adults who needed to acquire skills from each other. Conviviality describes a relation not only between the individuals of a group but also between groups. Group life and involvement was a component of pre-colonial Africa before the invasion and colonialism. The group was more important than the individual. In general, family and kinship were the determining factors in the ownership of land, recruiting of labor to work the land, and distribution of the fruits of that labor. Therefore, social, cultural, economic or political activities were collectively performed. This communality, collectivity and collectivism encompassed the holistic and productive lives of the community's members. It was unethical and a lack of *Ubuntu* for individuals to be self-centred. Conviviality is a philosophy that stresses the importance of ethical virtues in communal life. Inevitably, conviviality and *Ubuntu* promote responsibility and mutuality of good intentions or purpose. They support a defragmentary and unitary mode of relationship with one's own culture, including other cultures.

Illich's 1973 publication of *Tools for Conviviality* provides an ethical dimension to conviviality as it is defined as "an intrinsic ethical value." For Illich, conviviality is synonymous with "individual freedom realized in personal interdependence," it is the foundation of a communal society—one that gives its members the means, referred to as tools, for achieving personal goals within the community's or group's expectations. An individual who came up with an idea or a tool for alleviating the community's suffering was more respected than an individual whose achievement was merely for personal gratification. A convivial society would be the result of social arrangements that guaranteed each member the most ample and free access to the tools of the community and limited this freedom only in favour of other members' equal freedom. Polanyi (1964) describes it as synonymous with empathy "which can establish knowledge of other minds" (Caire, 2007, p. 195). Caire goes on to explain that empathy allows individuals to identify with others, hence provides a way to understand other individuals by experiencing their feelings, thoughts and attitudes, thereby acquiring personal knowledge.

Individuals who empathized with others' social and economic challenges were regarded as fully socialized members. Such members provided a foundation for a harmonious society, and were capable of applying their creativity and imagination for the benefit of all. Polanyi further describes a community as convivial when it aims at sharing knowledge: members trust each other, share commitments and interests and make mutual efforts to create and preserve conviviality (Caire, 2007). Conviviality is a mechanism to reinforce social cohesion and a tool to reduce mis-coordination between individuals, groups and institutions in communities (Caire, 2007). According to Taylor (2004), conviviality masks the power relationships and social structures that govern societies. A conviviality mask is a transformation of social dependencies by hiding power relations and social structures to facilitate social interactions.

Closely related to conviviality is the concept of reciprocity, which binds people and communities together. Reciprocity means that in response to friendly actions, people are frequently much nicer and much more cooperative than predicted by the self-interest model (Fehr & Gächter, 2000). Contrary to the cooperative model, George Stigler (1981) is of the opinion that when self-interest and ethical values with wide verbal allegiance are in conflict, much of the time, most of the time in fact, self-interest-theory will win. However, Fehr and Gächter (2000) do not agree with Stigler's assertion and argue, "When the world is made up of self-interested types and reciprocal types, interacting with each other, the reciprocal types dominate the aggregate outcome in certain circumstances, while the self-interested types will dominate the aggregate outcome in other circumstances" (p. 1). What this implies is that both self-interested individuals and reciprocal type individuals were able to coordinate their efforts for the good of society. This point relates very coherently to the idea of conviviality and its expressed provision of personal freedom and creativity for the good of the community and the exchange of ideas amongst members in the production and maximization of production. Indeed, the power to enhance collective actions and to enforce social norms is probably one of the most important consequences of reciprocity.

In pre-colonial African society, reciprocity strengthened the norms that called for collective actions, and those that operated at the level of self-interest were ridiculed and severely sanctioned. Positive reciprocity was deeply embedded in many social interactions. The exchange of tools or technology was widespread in traditional Africa. The blacksmith or ironsmith would exchange their products/tools with containers made by pottery workers. A social exchange system was fundamental to the continuation of industrial skills that were developed among groups within communities. Cosmides and Tooby (1992) argue that social exchange has been of central importance in human evolutionary history, and that the achievement of mutual cooperation in social exchange is one of the most important adaptive tasks humans have faced. Mutual cooperation was an imminent feature in the social and production processes in traditional societies. Strong social relations were cohesive to social and economic production in traditional societies. Self-interest was damaging to the harmonious social relations that promote community development. In pre-colonial African communities, a socially integrated society or community was more productive than the one that was disintegrated. Indeed, the power to enhance collective actions and to enforce social norms is probably one of the most important consequences of reciprocity. With reciprocity and conviviality a very high level of cooperation can in fact be achieved. Traditional African societies depended on the two principles to bring about participatory decision making in knowledge production and knowledge utilization.

COMMUNITY PROPERTY RIGHTS AND CREATIVE OWNERSHIP

Long before colonialism and capitalist imperialism and expansionism, indigenous peoples of the world lived in relative peace and harmony among themselves and

their natural environment (Shizha, 2008). However today, one of the overarching threats facing indigenous peoples is the risk of being dispossessed of their distinct livelihoods, their heritage and often their identity as a people (Mander & Tauli-Corpuz, 2006). Not only are they confronted with dispossession of their lands and resources, but they are also faced with the appropriation of their collective knowledge developed through the ages. Traditional knowledge of medicinal plants and crops is being taken by multinational companies, while traditional technology designs are being commercialized for the tourism industry. Subsequently, the issue of indigenous cultural property rights is becoming more and more urgent for indigenous peoples. Discussing proprietary rights, Hansen and VanFleet (2003) point out that:

> An important purpose of recognizing private proprietary rights is to enable individuals to benefit from the products of their intellect by rewarding creativity and encouraging further innovation and invention. But in many indigenous world-views, any such property rights, if they are recognized at all, should be extended to the entire community. They are a means of maintaining and developing group identity as well as group survival, rather than promoting or encouraging individual economic gain. (p. 4)

Prior to colonization, intellectual and cultural property rights were not an issue at all. It went without question that communities had the right to their cultural property. The arts, the tools and the knowledge that was utilized in designing the tools needed for daily living and creating the arts belonged to the people. The people's knowledge and people's science (Shizha, 2010) was the bedrock of the creative arts and technological outputs. Community ownership or common property regimes were a result of collaboration and participatory action which were "always the philosophical and ethical concerns in indigenous communities as depicted by the [Shona, an ethnic group in Zimbabwe] proverb *Chara chimwe hachitswanyi inda* (An individual cannot succeed by working alone)" (Shizha, 2009, p. 140).

A model of *sui generis* cultural norms gave societies and communities property-like rights over their collective knowledge (Correa, 2001). Indigenous communities had rights over their traditional knowledge and these rights extended to controlling access to ancestral lands, access to biological and genetic resources and to indigenous knowledge related to these resources. These rights were inclusive and not exclusive. The community owned the knowledge and the tools of production and the production that resulted from the efforts of its members. Common property regimes included various rights, relations, arrangements and cultural practices by which communities own, use and have access to natural, biological and genetic resources (Ahmed, 2000). The granting of exclusive rights would have limited rather than promote the use of traditional knowledge, and this could also have contradicted the practices and values of traditional and indigenous communities. According to Ekpere, (2000):

> Community rights and responsibilities that govern the use, management and development of biodiversity, as well as the traditional knowledge, innovations

> and practices relating to them, existed long before private rights over biodiversity emerged, and concepts of individual ownership and property arose. Community rights are thus regarded as natural, inalienable, pre-existing or primary rights…This system of rights, which enhances the conservation and sustainable use of biological diversity and promotes the use and further development of knowledge and technologies, is absolutely essential for the identity of local communities and for the continuation of their irreplaceable role in the conservation and sustainable use of this biodiversity. (p. 20)

The capitalist system of rewarding individuals was non-existent. The intrinsic reward system motivated members of the community. Intrinsic rewards were rewards that came from the inside of the person. Individuals and groups were given recognition for their special skills, and the praise they received gave them satisfaction and self-esteem.

Achievements that benefited society and the community and promoted community values were highly regarded and positively reinforced as they contributed to community success. Any form of individual monopolization could have contradicted the communities' practices and values. Monopolization that is being harshly driven by the corporate race to patent any form of technology, including genetic technology such as genes and cell lines of plants, seeds, and humans is fuelled by the desire to commodify our most precious resource: life itself. Commodification of life makes it "alienable," meaning it can be "owned, bought and sold" as it becomes "private property" (Mander & Tauli-Corpuz, p. 71). This immediately raises questions about who owns and who is owned. These contradictions to natural resources and the ownership of the resources were alien to pre-colonial African societies. Commodification of life would have been as good as destroying human life itself and being disloyal to the Great Spirits that provided people with their livelihoods.

Community rights recognized that the customary practices of local communities derive from a priori duties and responsibilities to past and future generations of both human and other species (Ekpere, 2000). This reflected a fundamental relationship with all life, and was imbued with an innate demand for respect. Scientific knowledge was holistic and inclusive, covering every aspect of human life. Scientific knowledge was created, shared and transferred from one generation to another within the communities or societies in which it was created. However, the sharing of knowledge was exchangeable between and among neighbouring communities and societies. There were no physical, social or cultural barriers that limited or prohibited communities from sharing and exchanging technologies that were created by one or another community. Actually, sharing knowledge and technology prevented misappropriation of indigenous knowledge of one community by another. Therefore, there was no need for societal or community demands for "protection" against misappropriation of their knowledge because customary practices and traditional systems of resource management, such as the protection of traditional knowledge against unauthorized use, were deeply entrenched in

pre-colonial African societies. Community or communal ownership guaranteed the group's right to protect and benefit from its own cultural discoveries, creations and products. The current practice to apportion patents as well as intellectual property rights to misappropriated indigenous material knowledge is a disservice to the indigenous people of Africa (Shizha, 2010b).

CONCLUSION

In this chapter the author has argued that traditional knowledge is collective in nature and is often considered the property of the entire community, and not belonging to any single individual within the community. It is transmitted through specific cultural and traditional information exchange mechanisms, for example, maintained and transmitted orally through elders or specialists (breeders, engineers, healers, blacksmiths etc.), and often to only a select few people within a community. Pre-colonial African societies were active in constructing knowledge and technologies that were appropriate to their societies and communities. African 'fine arts,' for example, is a known African achievement of the pre-European period which stands as a contribution to humanity's heritage of beautiful creations. The verdict of art historians on the Ife and Benin bronzes is well-known, and so is the art of Egypt, the Sudan and Ethiopia known to the rest of the world to be of an early date. Since they date from the 14th and 15th centuries, they are very relevant to any discussion of African development in the epoch before the contacts with Europe. They represent a technology that was not a Western construct. Tools used in production existed in all societies, except that in colonized societies technological advancement was inhibited by European adventurers.

African traditional scientific/technological knowledge was created in a manner that reflected the cultural traditions and economic needs of the communities. In terms of the dissemination of technology, it was learned from the specialists through hands-on experience—the apprenticeship system. Knowledge was created, preserved and disseminated by the community. In this regard, it belonged to the community, it was owned by the community. Unlike in contemporary society, there was no patenting of creative work; neither was there individual ownership nor intellectual property rights to protect the rights of individuals and their work. Intellectual property protections which may include patents, copyright, trademarks and trade secrets were an unknown foreign concept. Individualization of property/cultural rights went against the principles, norms, ethos and values of indigenous communities. Community members were connected by conviviality and the tenets of reciprocity. They were required to cooperate and collaborate in all forms of creativity and production. Through conviviality, the set of positive relations between the people and the groups that formed pre-colonial societies, with an emphasis on community life and equality rather than hierarchical functions, social integration and participation was encouraged. Individual freedoms and creativity were recognized through group performances and the outcomes of products, tools and

technology. Finally, technology was not advanced to manipulate and control life to attain some abstract notion of "progress," but was used to steward life, to care for it in a way that led to greater ecological and human well-being. Exploiting of the natural environment "was meant to maintain the balance between materialism and spiritualism, in the course of getting the immense benefits of science and technology" (Spring, 2007, p. 20).

REFERENCES

Abdi, A. A. (2003). Searching for development education in Africa: Select perspectives on Somalia, South Africa and Nigeria. *International Education Journal, 4*(3), 192–200.

Abdi, A. A., & Guo, S. (2008). Education and development: An introduction. In A. A. Abdi & S. Guo (Eds.), *Education and social development: Global issues and analysis* (pp. 3–12). Rotterdam, The Netherlands: Sense Publishers.

Adjei, P. B., & Dei, G. S. (2008). Decolonizing schooling and education in Ghana. In A. A. Abdi & S. Guo (Eds.), *Education and social development: Global issues and analyses* (pp. 139–154). Rotterdam, The Netherlands: Sense Publishers.

Ahmed, F. U. (2000). *Systems and national level experiences for protecting traditional knowledge, innovations and protections experience of Bangladesh*. Bangladesh: Mimeo.

Agrawal, A. (1995). Dismantling the divide between indigenous and scientific knowledge. *Development and Change*, *26*, 413–439.

Amin, S. (1989). *Eurocentrism*. New York, NY: Monthly Review Press.

Atte, D. O. (1989, February 21–24). *Indigenous local knowledge as a key to local-level development: Possibilities, constraints, and planning issues in the context of Africa.* Seminar on reviving local self-reliance: Challenges for rural/regional development in Eastern and Southern Africa, United Nations Centre for Regional Development and Centre on Integrated Rural Development for Africa, Tanzania.

Barua, B. P. (2010). Ethnic minorities, indigenous knowledge, and livelihoods: Struggle for survival in south eastern Bangladesh. In D. Kapoor & E. Shizha (Eds.), *Indigenous knowledge and learning in Asia/Pacific and Africa: Perspectives on development, education and culture* (pp. 63–79). New York, NY: Palgrave Macmillan.

Belanger, Y. D. (2010). *Ways of knowing: An introduction to native studies in Canada*. Toronto: Nelson Education.

Bisson, M. S. (1990). Prehistoric copper mining in north western Zambia. *Archaeology, 27*(4), 242–248.

Brach, C., & Fraser, I. (2000). Can cultural competency reduce racial and ethnic health disparities? A review and conceptual model. *Medical Care Research and Reviews, 57*(Suppl. 1)*,* 181–217.

Brownlie, R. (2005, May). *First nations thinking in Canada.* A paper presented at the University of Manitoba, Winnipeg, Canada .

Caire, P. (2007). *A critical discussion on the use of the notion of conviviality for digital cities*. IADIS International Conference on Web-Based Communities, Salamance, Spain.

Chambers, C. M., & Balanoff, H. (2009). Translating "participation" from North to South: A case against intellectual imperialism in social science research. In D. Kapoor & S. Jordan (Eds.)., *Education, participatory action research, and social change: International perspectives* (pp. 73–87). New York, NY: Palgrave Macmillan.

Correa, C. (2001). *Traditional knowledge and intellectual property: Issues and options surrounding the protection of traditional knowledge*. A discussion paper commissioned by the Quaker United Nations Office (QUNO), Geneva, with financial assistance from the Rockefeller Foundation.

Cosmides, L., & Tooby, J. (1992). Cognitive adaptations for social exchange. In J. H. Barkow, L. Cosmides, & J. Tooby (Eds.), *The adapted mind: Evolutionary psychology and the generation of culture* (pp. 163–228). New York, NY: Oxford University Press.

Davidson, B. (1992). *The black man's burden. Africa and the curse of the nation-state*. London: James Currey.

DePasse, C. (2008). Rivers of Babylon: Traditions in education for development. In A. A. Abdi & S. Guo (Eds.), *Education and social development: Global issues and analyses* (pp. 13–24). Rotterdam, The Netherlands: Sense Publishers.

Durkheim, E. (1933). *The division of labor in society*. New York, NY: The Free Press.

Ekpere, J. A. (2000). *The OAU's model law*. Lagos: Organisation of African Unity; Scientific, Technical & Research Commission.

Fehr, E., & Gächter, S. (2000). Fairness and retaliation: The economics of reciprocity. *Journal of Economic Perspectives*, *14*, 159–181.

Gennaioli, N., & Rainer, I. (2005). *Pre-colonial centralization and institutional quality in Africa.* A paper presented at the Conference on Political Economy and Development, CESifo Venice.

Ghosh, K. (2010). Indigenous incitements. In D. Kapoor & E. Shizha (Eds.), *Indigenous knowledge and learning in Asia/Pacific and Africa: Perspectives on development, education and culture* (pp. 35–46). New York, NY: Palgrave Macmillan.

Gianan, N. A. (2010). Valuing the emergence of *ubuntu* philosophy. *International Journal of Philosophy of Culture and Axiology*, *VII*(1), 86–96.

Hansen, S., & VanFleet, J. (2003). *Traditional knowledge and intellectual property: A handbook on issues and options for traditional knowledge holders in protecting their intellectual property and maintaining biological diversity.* Washington, DC: American Association for the Advancement of Science (AAAS).

Haque, E. (2010). Development enterprises and encounters with the Dayak and Moi communities in Indonesia. In D. Kapoor & E. Shizha (Eds.), *Indigenous knowledge and learning in Asia/Pacific and Africa: Perspectives on development, education and culture* (pp. 97–112). New York, NY: Palgrave Macmillan.

Hornby, A. S. (2002). *Oxford advance learners dictionary*. Oxford: Oxford University Press.

Illich, I. (1971). *Deschooling society*. New York, NY: Harper & Row Publishers.

Illich, I. (1973). *Tools for conviviality.* New York, NY: Harper & Row Publishers.

Mander, J., & Tauli-Corpuz, V. (Eds.). (2006). *Paradigm wars: Indigenous peoples' resistance to globalization*. San Francisco, CA: Sierra Club Books.

Miller, D. E., & Maggs, T. (1994). *Pre-colonial metalworking in Africa, especially southern Africa: A bibliography* (pp. 1–67). Cape Town, South Africa: Department of Archaeology, University of Cape Town (African Studies Library).

Ngara, C. (2007). African ways of knowing and pedagogy revisited. *Journal of Contemporary Issues in Education*, *2*(2), 7–20.

Onimode, B. (1982). *Path to Nigeria development.* Ibadan: UPL.

Onipede, K. J. (2010). Technology development in Nigeria: The Nigerian machine tools industry experience. *Journal of Economics*, *1*(2), 85–90.

Olaoye, R. A. (1992). Indigenous technology in Nigeria. *The Chronicler, Journal of the Students' Historical University of Ilorin*, *7*, 2–4.

Pole, L. M. (1975). Iron-working apparatus and techniques: Upper Region of Ghana. *West African Journal of Archaeology, 5*, 11–39.

Rahnema, M. (1990). Participatory action research: The "last temptation of saint" development. *Altematives, XV*(2), 199–226.

Rodney, W. (1982). *How Europe underdeveloped Africa*. Washington DC: Howard University Press.

Schoffeleers, J. M. (1979). *Guardians of the land: Essays on Central African territorial cults*. Gwelo, Zimbabwe: Mambo Press.

Semali, L. (1999). Community as a classroom: Dilemmas of valuing African indigenous literacy in education. *International Review of Education*, *45*(3/4), 305–319.

Shaw, T., Sinclair, P., Andah, B., & Okpoko, A. (1993). *The archaeology of Africa – Food, metals and towns*. London: Routledge.

Shizha, E. (2006). Legitimizing indigenous knowledge in Zimbabwe: A theoretical analysis of postcolonial school knowledge and its colonial legacy. *Journal of Contemporary Issues in Education, 1*(1), 20–35.

Shizha, E. (2007). Critical analysis of problems encountered in incorporating indigenous knowledge in science teaching by primary school teachers in Zimbabwe. *Alberta Journal of Educational Research, 53*(3), 302–319.

Shizha, E. (2008). Globalization and indigenous knowledge: An African postcolonial theoretical analysis. In A. A. Abdi & S. Guo (Eds.), *Education and social development: Global issues and analysis* (pp. 37 –56). Rotterdam, The Netherlands: Sense Publishers.

Shizha, E. (2009). Chara chimwe hachitswanyi inda: Indigenizing science education in Zimbabwe. In D. Kapoor & S. Jordan (Eds.), *Education, participatory action research, and social change: International perspectives* (pp. 139–153). New York, NY: Palgrave Macmillan.

Shizha, E. (2010a). The interface of neoliberal globalization, science education and indigenous African knowledges in Africa. *Journal for Alternative Perspectives in the Social Sciences (JAPSS)*, *2*(3), 27–58.

Shizha, E. (2010b). Rethinking and reconstituting indigenous knowledge and voices in the academy in Zimbabwe: A decolonization process. In D. Kapoor & E. Shizha (Eds.), *Indigenous knowledge and learning in Asia/Pacific and Africa: Perspectives on development, education and culture* (pp. 115–129). New York, NY: Palgrave Macmillan.

Shizha, E. (2011). Neoliberal globalization, science education and indigenous African knowledges. In D. Kapoor (Ed.), *Critical perspectives on neoliberal globalization, development and education in Africa and Asia* (pp. 15–31). Rotterdam, The Netherlands: Sense Publishers.

Spring, J. (2007). *A new paradigm for global school systems: Education for a long and happy life*. Mahwah, NJ: Lawrence Erlbaum.

Stigler, G. (1981). Economics or ethics? In S. McMurrin (Ed.), *Tanner lectures on human values*. Cambridge: Cambridge University Press.

Taylor, M. (2004). Oh no it isn't: Audience participation and community identity. *Trans, Internet Journal for Cultural Sciences*, (15).

PART 2

INDIGENOUS PHYSICS AND COSMOLOGY

VONGAI MPOFU

5. TIME

An African Cultural Perspective

INTRODUCTION

The Africans' concept of time is rooted in their indigenous worldview of understanding the interconnectedness and holism of their place in the universe. It is framed in discrete terms of circular patterns that are marked by the space between two events. While Western science presupposes rectilinear time, indigenous worldviews frame time as cyclical terms of related space size, progression and continuity. This comes from long observation of other elements of the universe that are applied in managing time. Time is defined in qualitative terms rather than as quantitative, numerical, physical, measured space. It is embedded in real-life events and is learnt from recurrent natural events. This means that time is deduced from life events and is a lived experience. These natural events include, life (for example, menstrual cycle, cockerel crowing, and the behaviour of snakes and frogs), celestial (for instance, the sizes and direction of shadows, appearance and patterns of stars), among others. Such events are synchronized to human activities and life experiences that give the African conception of time a perceptual dimension. For example, the peoples' observations of the sun's position in the sky coincide with their cycles of work and rest through their everyday chores for survival. This lived experience dimension of African time embraces the physical, emotional, mental and spiritual relationships associated with African rituals, myths and ceremonies. This chapter unpacks this African conception of time that harmonizes with the myriad of cycles observed in the world. The author draws from the *Karanga* cultural background to give insights into cycles, progression and continuum in the African lens of time. The author consulted some elders of a rural community of Bindura District in the Mashonaland Central province in Zimbabwe to enrich the chapter. Furthermore, the author illustrates that this cyclic understanding of time enables Africans to envisage futuristic events (for example, *mukwerere*—rain-making ceremonies) as marked by previous related events and the hope of having these events fulfilled to sustain life. This chapter has the potential to influence some people, particularly those from a western cultural background, to understand and appreciate the African concept of time as an alternative way of knowing. In addition, the chapter might provoke research in time from the African perspective in different localities. The chapter is organized around four broad areas: African indigenous worldviews, rectilinear time,

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a circular socio-cultural frame and a multidimensional socio-cultural perspective. It concludes with a critical multidimensional application of this chapter's content to indigenous knowledge discourse.

THE AFRICAN CONCEPT OF TIME

Time is a fundamental aspect of human life and experience. It is shared by all humans despite their cultural background. However, conceptions of time vary among humans. The differences are rooted in different ways of knowing and living with nature in different parts of the world. Thus, the concept "African concept of time," is to a larger extent an acknowledgement of the diversity of worldviews held by people of different cultural backgrounds. In relation to time, some worldviews might converge with the African concept while others may be divergent and conflicting. Many people, particularly those with a western cultural background use the expression "African time" to imply that Africans do not value rectilinear time, are non-time conscious and have no sense of time. Surprisingly, even some of the African western-educated scholars, like Mbiti (1969), hold this perception. Such people might not know that they are almost assimilated into the western ways of understanding and the use of time. An examination of the African frame of time will go a long way to unveil the perspective of Africans about time as a socio-cultural reality. This chapter might contribute to the decolonization of the minds of some African indigenous people that seem to have lost the sense of African-centred thought and wisdom. In fact, the perception that Africans have no sense of time raises epistemological and ontological debates. The 'real' Africans have no sense of the western perspective of time. However, these Africans have a strong sense of time rooted in their African indigenous ontologies and epistemologies. African indigenous time is programmed into real-life events and relates to the survival of indigenous people. Africans have a socio-cultural frame of time that sustains their lives. Their concept of time contrasts with the rectilinear model that is rooted in the Western worldview, which is practically alien to 'real' African thinking.

THE AFRICAN WORLDVIEWS: *UNHU/UBUNTU*

An understanding of the *Unhu/Ubuntu* worldview is required to grasp an understanding and respect for African concept of time. *Unhu*—an African indigenous worldview shares assumptions with other indigenous worldviews. But before unpacking what the *Unhu* worldview entails, perhaps there is need to clarify the use of the term indigenous in relation to this chapter. The term indigenous is hard to define. McKinley (2007) asserts that "indigeneity is a heterogeneous, complex concept that is contextually bound" (p. 202). In the literature, it is often used as a descriptor to identify or characterize something (for example, people, knowledge, culture, worldviews, etc.) in relation to places of habitation or origin. The qualification "contextually bound" does not only indicate that "there is no universal definition

of Indigenous" (Aikenhead & Ogawa, 2007, p. 555), but also links anything that is characterized as indigenous to a particular locality. The people and their knowledge, views of the world and cultures are linked to the genealogy and "descendants of the first people to inhabit a locality or place" (Aikenhead & Ogawa, 2007, p. 556). Often these people and their knowledge systems are likely to have experienced various forms of colonization by western dominating nations. African people, their knowledge, cultures and worldviews were and are still dominated and marginalized by western hegemonic ideologies. As such, Odora Hoppers (2002) links the term indigenous to the people, knowledge, worldviews and cultures that have been or were previously colonized and dominated, and currently striving to decolonize themselves and their knowledge systems from western imperialism (Battiste & Henderson, 2000). This view covers all indigenous people around the world, including the Aborigines of Australia, Maori of New Zealand, the First Nations of Canada, Indians, Africans and many others.The term *Africans*, in this chapter, refers to the indigenous people with a genealogy of African ancestors. Although some of these people might have been colonially exposed to western cultures, they have to a large extent retained their African ways of knowing and worldviews.

Simpson (2000) observes that indigenous people view life and knowledge in the universe as holistic, cyclic and interdependent. Holistic connotes completeness, which means, one whole made up of inextricable and interwoven parts. Battiste and Henderson (2000, p. 43) contrast the holistic, indigenous knowledge worldview to the reductionist nature of western scientific worldview. They argue:

> No separation of science, art, religion, philosophy or aesthetics exists in indigenous thought; such categories do not exist. Thus, Eurocentric researchers may know the name of a herbal cure and understand how it is used, but without the ceremony and ritual songs, chants, prayers, and relationships, they cannot achieve the same effect. (Battiste & Henderson, 2000, p. 43)

It is evident, therefore, that within the whole of existence, all the elements of nature form a web of interrelationships. They intimately connect with this whole and are dependent on each other. The cyclical view of the world originates from the idea that all things are in a constant motion or flux (Little Bear, 2000). For something that is holistic, constant motion is observed in cyclical and repetitive patterns. For instance, the human life cycle has a regular pattern that results in conception, birth, growth and death.

Africans, like any other indigenous people around the world, live in harmony and intimate relationships with their non-human cohabitants. Africans believe in ordered responsibilities and roles within their communities but insist on respectful relationships among the human and non-human members of the community. Indigenous people have lived with these elements, studied them and developed knowledge and skills that enable them to survive. They have become specialists in understanding the interconnectedness and holism of their place in the universe. Be that as it may, these indigenous worldviews vary from place to place. According

to Cajete (2000), the place is a land space, a locale to a group of people habiting it. It provides its habitants with the environment to interact with and learn from for living purposes. The place is also relational as well as experiential. As a result, the land describes the nature that provides a blueprint for living well in it and all that is necessary to sustain life (Michell, 2005). Consequently, epistemological and ontological variations come from contextual individual experiences accumulated in one's land of origin.

Unhu is an African worldview that is a variant of the indigenous worldviews and one manifestation of the many worldviews that are reflective of African communities. *Unhu* emphasizes symbiotic relationships among members of African communities (Moyra, 2008). Within a typical African village, the biological (people, animals and plants), the physical (mountains, rivers) and the spirits (metaphysical) elements are all related and dependent on each other. These elements make up a larger whole that embodies two dialectical wholes, the first and the second worlds (Matsika, 2012). The first world relates to the metaphysical world whilst the second world relates to the physical world. In the language of Ermine (1995), the first and second worlds relate to the indigenous outer space and inner space respectively. Within the *Unhu* worldviews, one example of the manifestation of the interactions between the spiritual and natural world within a community is ancestral relationships defined through totems. Totems, usually animals, like the Shava (Eland), connect the living to their ancestors and the animal. According to Ampadu-Agyei (2003) cited in Francis (2008):

> Totems refer to vegetables or animals which are revered by individuals, particularly a group of people or a tribe as sacred. A totem can be an animal, a plant or any other natural object believed to be ancestrally related to a tribe, clan, or family group as a tutelary spirit. For this reason, the members do not eat, kill or trap such animals or birds or fish. (pp. 19–20)

The places where ancestors are buried are defined as sacred and this provides another link to the caves. Within an indigenous community, spirituality is highly respected as it embodies relationships between people and ancestors, self and collective empowerment, metaphysical and psychic powers, healing and wholeness (Dei, 2011). It connects and holds together these natural and metaphysical elements. The human respect of spirits allows them to be guided by the 'I am because others are' principles of communalism (Moyra, 2008) and sustaining familial relations (Weaver, 2001).The *Unhu* worldview presumes that all people within the village are relatives. This way of viewing a group of people leads to treating each other with respect for the good of the entire group or community. At an individual level, cultural-traditional values of good manners and empathy are needed for dialogue and building of collectivism (Shizha, 2010).

The *Unhu* worldview, as any other indigenous worldview, holds epistemologies that predicate time cyclically. The cyclic conception of time is in contrast to the western scientific epistemology that presupposes rectilinear time. "Cyclical time

swings back and forth, rhythmically, between repeated events" (Kearney, 1984, pp. 98–99) providing discrete and functional purposeful time interpretation. By perpetuating events in the past, indigenous Africans conserve their history, propagate ancestor and deity worship, and continue a strong sense of African religious customs. It enables predictability in the life history of a culture.

RECTILINEAR TIME

Universal rectilinear time is presupposed by western scientists and, therefore, rooted in western scientific worldviews. Bolter (1984) argues that the concept of rectilinear time is a product of western scientific knowledge and the creation of the mechanical clock. He draws this argument from his study of the concept of time held by ancient Greeks, Europeans in the Middle Ages and Renaissance, and modern computer engineers. He believes that the western scientific inventions that resulted in the rectilinear concepts of time have roots in cultural technologies. Consistent with the indigenous ontologies of multiple realities, Bolter (1984) argues that prior to the era of the mechanical clock, the concept of time varied in accordance with the technologies of specific western cultures. Such a culture-specific perspective of time frames multiple time concepts that contradict the universal rectilinear time concept grounded in Western scientific culture. As is quite familiar to many, rectilinear time is a quantitative ratio-scaled measurement. It is uniformly and limitlessly linear, and calibrated by identical, mathematical, arbitrary units. Through a series of western scientific works, rectilinear time became an abstracted western scientific reality from Newton's (1687) Principia: "Absolute, true, and mathematical time, of itself, and from its own nature, flows equably without relation to anything external" (Cajori, 1962, p. 6). This marked the abandonment of the western cultural conception of time in favour of rectilinear time in the history and philosophy of science. To date, many Africans and non-Africans heavily depend on the watch for time. The watch has become the symbol for rectilinear time.

CIRCULAR SOCIO-CULTURAL TIME

An alternative to rectilinear time is cyclical time (Peat, 1994). It is a shared social-cultural conception of time among many indigenous cultures. It is a concept of time that harmonizes with the myriad of cycles observed in nature (Aikenhead & Ogawa, 2007). The cycle forms a whole and, therefore, makes the understanding of time discrete. However, to Africans, what is important is what happens in the space between two events that leads to one complete cycle, rather than the number of lived cycles. This provides a descriptive sense of time. The kind of thought system about time which the author observed among the Elders as the author grew up in a rural village is intimately linked to patterns of nature and social-cultural events. Reflecting back to life in the village, the author now realises that the Elders tied time to different types of events, such as cattle herding, ceremonies, meal times and

even human development and growth. These human activities were and are aligned with natural events, including the life process of plants and animals, and celestial and seasonal patterns. When a baby boy was born, the Elders in the village would comment: "a boy is born again in this village. We need to plant more *mhunga* (pearl millet) and *rukweza* (finger millet)." To the Elders in the Gwizi community of Chibi district of Masvingo in Zimbabwe, the birth of many male children in the village was a sign of a drought year—the African's conception of time as a socio-cultural lived experience (Babalola & Alolan, 2013).

As yet another example, a day's cycle is arrived at in several ways, including the sunrise. Every sunrise meant a complete day. The sizes of the cycles varied and built into the future, at the same time leaving landmarks of the past. They identified different cycles such as life cycles, celestial cycles, seasons, and daily cycles, using a variety of observations. Their observations were triangulated to validate their reality of time cycle. For example, the cock-crows are compared with different patterns of movement of the sun, moon and stars. To the African, both the event and human socio-cultural activities that take place between the two similar events constitute cyclic time. The notion of time is based on cyclic phenomena; hence, their time is cyclical as opposed to Western science's rectilinear notion of time.

African ways of knowing time reflect an intimate relationship with nature, which "tend to focus on relationships between knowledge, people, and all of creation" (McGregor, 2002, p. 2). Thus, the African's observation of nature and socio-cultural activities make up commonly agreed-upon ways of determining a day, week, month, season and year without reference to the calendars and clocks. The author's parents were western-trained primary school teachers, but interestingly they incorporated the cyclical conception of time in their home and the rectilinear conception of time within their professional workplace context. The moment they got home from school, they would put their wrist watches in locked drawers and resume managing home chores within a cyclic, cultural conception of time. Drawing from the conversation the author held with some Elders about time, today rural community people, despite wearing watches, still culturally manage their time through observation and oral transmission. In fact, this oral tradition within real-life activities of passing knowledge, from one generation to the next, is typical of indigenous Africans (Dei, 2011).

As a matter of survival, each generation sought to live in harmony with other creations of nature, learn from the other and made good use of the knowledge gained. Africans strongly believe that their knowledge and wisdom comes from their ancestral spirits, instructed by the Great Spirit (Ngara, 2007). The Great Spirit is God, which indigenous Zimbabweans express in diverse dialects, including *Mwari, Musikavanhu, Nyadenga, Musiki*. As such, Africans reckon that all their co-habitants (for instance, animals, insects, the stars) within their communities hold knowledge they can learn and make use of in their daily lives, as guided and mediated from God by their ancestral spirits. They share the belief that the Great Spirit created the non-human aspects of the physical world for humans to use respectfully, to

live and prolong their lives in the second or physical world (Matsika, 2012). Their *Unhu* worldview leads them into appreciating and respecting the presence of other elements of the community and the knowledge they hold for them. They have been taught by their parents and experiences in the villages that the eyes, ears and mind are opened up by their ancestral spirits to generate wisdom from their co-habitants and get life out of them. They believe that the Great Spirit wants them to live a good life through hard work and respectful use of the natural resources. Time is a resource whose utilization has to reflect the worldview of communalism and values of respect and sacredness. As such, Africans are educated to synchronize their survival chores with daily, monthly, seasonally and yearly cycles. They predict weather patterns and time based upon observations of behaviour of flora and fauna in their surroundings to prepare for their day. For instance, the crowing of the cock plays a significant role in predicting time. As I introspected on my upbringing with reference to the concept of time from an African perspective, I vividly recall my mother shouting at us (my sisters and me) each time we overslept and did not wake up after the cock had crowed for the third time. My mother would say:

> The cock has crowed for the third time, all the birds are now moving around but you are still sleeping. How many times do I have to tell you that the crowing of the cock means get up and work for your children? (But I was still in primary school). What will be of you when you become a mother? Sleep after the cock crows and wake up when the sun is above all the trees…your children will always be hungry. I warn you no man would marry such a woman.

These words carry a socio-cultural meaning of time that is linked to signals from birds, the position of the sun relative to the size of the tree and *behaviour shaping* in anticipation of community-expected values, and futuristic roles at adulthood. This expression of time is typical in many African villages. In fact, the start of the day is linked to the natural phenomena occurrences within the community environment. Human activities, such as tilling the land, sowing, pounding grain or other activities start with the events occurring in the natural environment. These include the sounds of domesticated birds and the position of the sun. For instance, my mother insisted on her children waking up between the second and third cock crow despite her uses of rectilinear time-keeping at school. This was the time to get up and start our daily chores. She insisted on paying particular attention to the sound of the head cock. By so doing, she was instilling the values of working hard and being responsible. My father would always talk of wisdom time. By wisdom time he referred to the sleeping night time during which he educated us that it was time for the ancestors and the Great Spirit to give us life directions through dreams. He always said, "Go to sleep, do not waste time lest you will miss *njere dzehope.*" Figuratively, this Shona expression means wisdom rooted in dreams.

As I grew older, I realised that Elders in my village, including my biological parents, grandmothers and relatives in our community triangulated the animal-indicated time with not only astronomical patterns of stars like *hweva* (morning star

or Venus planet), and weather patterns, but also the position of the sun relative to the heights of mountains and trees. The Zezuru Elders (a tribe within the Shona people of Zimbabwe) who participated in the *dare* (Shona cultural meeting) conversation session of time referred to *hweva* as *nyamasasi.* My mother made reference to the rising of the sun, its position in the sky and related it to the height of trees. The Elders, for instance, can determine the break of dawn by viewing the *hweva* star and the accompanying *vutonga* (dawn). The local villagers reinforced this link between celestial bodies to heights of mountains, hills and trees in managing time when one of them said:

> There was an early morning bus to Harare that left this place around four o'clock in the morning. We never used the watches but just new the time to get to the bus stop when the nyamasasi was in line with that mountain (he pointed at it).

Vutonga is the red-orange colour seen in the sky in the direction of the sunrise. It is seen just before the *hweva* star rises. The teaching about the *hweva* and its morning time indication is embedded in the Shona song *kunze kwayedza kunotanga hweva* (the *hweva* has risen indicating dawn).

From sunrise, the members of an African community use shadows cast by them, buildings or plants. They locate the position of the sun using their hands, eyes and body sensations to determine working and resting time. Furthermore, when the Elders are working in the fields, they judge the time to return home as determined by the weather conditions, the length of return journey alongside the sounds of certain stork birds. For instance, one Elder, a member of the village head council, said:

> When we hear the crow of the haya (Rain cuckoo) bird we know that the rains are coming. These birds drink water from mhango yemuti (cavity of the tree). It celebrates the coming of the rains by crowing. It makes different sounds that show how far the rains are. So if it makes a sound that shows that the rains will drop in a short while (mvurayehore) we go home early. The other sound means the rains are coming but later on and this gives us more time to work. The silence of this bird means there are no rains.

The excerpt above reinforces the argument that African time is tied to events, natural and human. Africans rely on nature for deciding resting and working time. They also predict weather patterns through a deep understanding of the behaviour of other living animals in their environment. Every community member learns what the sounds of the bird mean from experience. In this case, the Elder holding such knowledge simply pronounces that it was time to go home when the *haya* bird has spoken. The next time this bird crows, everyone else, including children, will know the meaning behind the crowing. In Buhera district in the Manicaland province of Zimbabwe, Mararike (1999) established similar interpretation of the singing of the *haya* bird in the early summer as signalling the beginning of the season. This agrees

with Mapara's (2009) finding that the Karanga people foretell the falling of rain in the next hour or two upon hearing the sound of *dzvotsvotsvo* (the rain bird). Stock birds also predict weather patterns. For example, the surfacing of *madzoramombe* (migratory birds or white storks) in Zimbabwe indicates an imminent rain season.

In African cultures, the days are small cycles that feed into larger cycles of weeks, months and years. Days, weeks, months and years are repetitive and progressive. Cultural taboos, rituals and ceremonies serve as markers of time during the small or bigger cycles. To emphasize this observation one village head said:

> Too many sugar or mobola plums presage little rainfall and a drought summer season and therefore low harvest. The ancestors provide these fruits so that people do not die of hunger. It also informs us to conserve our reserves as much as possible for future consumption. We also start outsourcing food (kusunza). This also helps us to prepare for plants or crop varieties which do not require a lot of water.

The excerpt above gives insights into the African socio-cultural concept of time in several ways. First, the sugar plum (*muzhanje*) and mobola plum (*muhacha)* trees bear fruits towards the rain season but some Shona communities in Zimbabwe believe that too many mobola plums signal a drought season. Apart from these trees, the Elders construe the budding of other trees like the *munhondo* (*berlinia globiflora*) and *musasa* (*brachystegia spiciformis)* as indicative of summer being around the corner and time to prepare for sowing. Tree flowering (*pfubvunza)* provides some indication of time because they bloom and bear fruit only once a 'year', thereby giving the people an easy way to determine the coming of a new and busy agricultural season. Villagers use the flowering time of the *munhondo or mutondo* tree to decide what crop to sow on a bigger piece of land that year. When these trees flower early they know that it was a wet season and they consider planting *mupunga (*indigenous rice) or maize, more than *rukweza/zviyo* (finger millet), *mapfunde* (sorghum) and *mhunga* (pearl millet). The late flowering of these trees is interpreted as signalling a drought year. This is when more drought-resistance crops were planted on a bigger hectare of the field in contrast to those in need of adequate rains. Every year such observations were made and Elders reckoned a complete cycle of a year with such events.

The summer season is recognized in other ways that evidence Africans' belief in the spiritual rooted life. For instance, Elders present a sample of field crops to the ancestors before the people are allowed to consume the crops. This cultural protocol is followed as a way of thanking the ancestors for the good rains and the crops. The initial consumption of crops is sanctioned by the traditional chief after the *kusuma* (a cultural gesture of respect, appreciation and reciprocity). The Elders said the crop samples are presented to places recognized as sacred. They emphasized that the violation of this cultural taboo led to the destruction of crops by wild animals such as baboons. Violation of cultural taboos is regarded as a sign of disrespect that calls for

punishment not of the offender but the entire community or many communities. This collective punishment is again a manifestation of the communal worldview of the African people. At the end of good harvest a similar event is conducted as a cultural ritual that serves to thank the ancestral spirits for the peace and harvest granted to the community people. The *kusuma* before eating the crops and after harvesting are connected to the ripening of field crops. Such ceremonies are conducted on predetermined fixed dates, but are dependent on the natural progression of life, agriculture and nature. They follow natural cyclical events; human life processes and associated rituals also follow natural cyclical events. For example, it is not unusual to hear Elders talk about holding a ritual to bring the spirit of the dead into the home (*kurova guva*) after the rain season. Most community members holding this cultural belief are aware that it is a taboo to hold the 'spirit return home' ritual before the grave of the dead person has been rained upon. So this ritual has no fixed quantitative measure, rather it is determined by the death event and the raining event. Again the event is linked to the time of the year.

Apart from field crops, most African people also judge time based upon the behaviour of several insects and frogs. For example, the appearance of black insects (*chifuramumera*) is associated with the beginning of the planting time. These insects only appear during the planting to harvesting period. The Elders recognize the frog sounds as their way of celebrating the rains. They understand the patterns of rainfall from particular sounds of some frog species. The bull frog croaking with high tone signified rains coming in the next day. Their observations of the behaviors of other living organisms is used to predict the quality of the season. For example, the incessant singing of *mandere* (day-flying chafers) signals the nearness of rainfall. Likewise, the singing of *nyenze* (cicadas) signals the commencement of rains in two to three weeks' time. Other insects that inform them about the cropping season include *makugwe (brachytrupesmembranaceus)* and *mopani* worms. Muguti and Maphosa (2012) established similar patterns in their study of indigenous weather forecasting among the Shona people.

In each cycle, there is rest time and work time garnered from weather patterns, plant and animal life processes and the state of the harvest. For instance, in a day cycle, the night is put aside for resting and the day for working as determined by the darkness and light. During the day, the sun's position, the heat, direction and positions of shadows as well as individuals' feelings, determine resting and working times. The light from the sun is viewed as purposeful to enable the community members to see what they will be doing throughout the day. Week cycles are mostly separated by a period of rest called *chisi*. This is a cultural taboo that bars community people from doing hard work such as planting, tilling and ploughing on a day designated by the Chief of the community. The month of *Mbudzi* (November) is regarded as sacred and, therefore, cultural activities such as marriages, rituals and ceremonies are suspended. Elders believe that this is the period when their ancestral spirits are carrying out meetings in their spiritual realms to decide on the request from the second world and other important issues of human life.

MULTIDIMENSIONAL SOCIO-CULTURAL TIME

There are several socio-cultural events that are conducted within the "right-time and sacred-time" concept of Africans. Members of a family, for instance, may gather for the "spirit of the dead return home" ritual (*kurova guva*). This ritual involves several stages. One of the stages vital to subsequent stages of this cultural process is called *kuzunza mbudzi* (making the goat shake). This goat shaking stage is culturally symbolic to the emotional state of the returned spirit and his or her acceptance to be returned home. It determines the progression and pace of subsequent events of the ritual process.

Lee, Yen and Aikenhead (2012) made similar observations among indigenous Elders in the Amis community when they found out that Elders "talk about 'when the time is right', then we can start an event or progress with it" (p. 1188). Thus, an event should begin or progress with the Elders' satisfaction that the environment is conducive to all the involved parties, the spiritual and physical people. Not only does the people's holistic (physical, emotional, mental and spiritual) state of being need to be in sync with the event, but more importantly the inner and outer spaces as well. What is happening in the physical world should be in alignment with the happenings of the first world. So the Elders wait for such cultural symbolic signals irrespective of how much time it takes. The Elders are aware that repetitive cycles in indigenous outer space interact with cycles in inner space (Ermine, 1995). Such cultural rituals and ceremonies are believed by the Africans to be spiritually connecting the present people in the first world with those of the past generations in the second world. As Lee et al. (2012, p. 1188) explain, such cultural ceremonies through the lens of cyclic time are "not time living in the past, but a natural relationship in the web of relationships of existence presupposed by indigenous ontologies."

From another perspective, indigenous time operates within a socialized conception. Such a perspective means that time is programmed into socio-cultural norms and values that shape human behaviour and interpersonal relationships. Socialized time originates from the *Unhu* worldview. It challenges Mbiti's (1969) view of time as having no academic importance. Systems programmed on linear time obviously conflict with indigenous systems of education which are embedded in the real and cyclic lives of the Africans. Apart from being reckoned by animal sounds, plant behaviour and astronomic patterns of the stars, moon and sun, time is attached to social activities such as milking cows, fetching water and time of return from the fields. These social activities carry cultural survival meaning. Knowing is embedded in those activities as exemplified by nature observations. The *Unhu* philosophy dictates that through the lens of socialized time, the use of time chores does not sacrifice social duties and human relations on the rectilinear time punctuality. This is because community interests and living in harmony surpasses an individual's interests.

Another dimension focuses on situations in African cultures when time is multitask managed and not controlled by successive and sequential events based on linear views of time. In this sense, time is polychromous, that is, an individual

simultaneously does more than one thing within a given period. This again contrasts with western culture and its academic programs that are sequential, successive and ordered. For instance, it is typical of African ways of living in rural communities for mothers to till the land, at the same time nursing or carrying the baby on their back while looking after the goats. In other words, responsibilities are combined within the same period of time and are rooted in the collectivism principle of *Unhu* as well as the circular sense of time. Such an approach also manifests itself at interpersonal interactions and relationships. It is, therefore, not unusual for Africans to engage in simultaneous conversations. This is different from managing one thing at a time in a strict sequence rooted in the western culture of managing rectilinear time. The criticism that Africans have a lax attitude about time may be ignoring this polychronic approach in managing tasks, events and interactions. As Lee et al. (2012) argue, this reveals the holistic time sense that takes care of the emotional and spiritual aspect of others. All this is grounded in the *Unhu* worldview that calls for respect, empathy and togetherness.

The African perspective of time has a past, present and future dimension contrary to Mbiti's (1969) view that focuses only on the past and immediate. With respect to the Yoruba perspective of time, Ayoade (1997) explains that the future life even extends beyond the end of this life to an afterlife. Drawing from my own experience and the group conversation I had, futuristic time is inferred from various symbolic expressions that make reference to infinite time. For example, the metaphor "*chisi hachieri musiwacharimwa*" meaning that the consequences of violating cultural taboos are not immediate but prolonged, implies a future event. Another example is that when the Shona people in rural Zimbabwe are conducting the rain ceremonies (*mukwerere*), they consult their ancestors to determine the future. The infinite future comes with the living anticipating several more rain ceremonies in the future.

Despite the events I have discussed above that denote discrete time, Africans manage their time on definite and accurate time, that is, when the socio-cultural context demands that things must happen, have effect, or must be done at a particular time. Some rituals need to be conducted on definite time, particularly those associated with healing and exorcism. In such cases, Africans engage in the measurement of such specific time. For example, the ritual might be said to start with the first cockcrow and surely by that time people will be gathered to perform it. The Elders use figurative or symbolic expressions that depict definite time. For example, the statement that "*tisangane nehweva*" implies "let's meet with the rise of *hweva* star" and is specific and accurate. Such examples show that Africans also conceive time in the punctual sense. However, all this depends on the context of the event.

CONCLUSION

This chapter reflects on Africans' conceived ideas about time. Drawing from the discussions above, the argument is that Africans are as time-conscious as all other races, such as Europeans, Asians and others. But its discrete, multifaceted and

socio-cultural context contrasts with the numeric, continuous and objective nature of linear time. It is not that Africans have no sense of time and are lax towards time, rather than their time concept is broad, multifaceted and socio-culturally specific. It extends beyond the physical world of reality into the metaphysical world. The African conception of time is rooted in indigenous worldviews of interconnectedness, interdependence and spirituality among all elements of nature. It is therefore reflective of the African cultural identity and worldviews. So calling on African individuals to be punctual or on the clock when they are being pensive, implies asking him or her to abandon their African indigeneity. Real Africans will not necessarily do so, if operating under sacred time.

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REFERENCES

Aikenhead, G., & Ogawa, M. (2007). Indigenous knowledge and science revisited. *Cultural Studies of Science Education*, *2*(3), 539–620.

Ayoade, J. A. (1997). Time in Yoruba thoughts. In R. A. Wright (Ed.), *African philosophy: An introduction* (pp. 93–111). Washington, DC: University Press.

Babalola, S., & Alolan, A. (2013). African concept of time: A socio-cultural reality in the process. *Journal of Education and Practice, 4*(7), 143–147.

Battiste, M., & Henderson, J. Y. (2000). *Protecting indigenous knowledge and heritage.* Saskatoon, SK: Purich Publishing.

Bolter, J. D. (1984). *Turing's man: Western culture in the computer age.* New York, NY: Viking Penguin Inc.

Cajete, G. (2000). Indigenous knowledge: The Pueblo metaphor of Indigenous education. In M. Battiste (Ed.), *Reclaiming indigenous voice and vision* (pp. 181–191). Vancouver, BC: University of British Columbia Press.

Cajori, F. (1962). *Sir Isaac Newton's mathematical principles of natural philosophy and his system of the world (Principia)*. Berkeley, CA: University of California Press.

Dei, G. S. J. (2011, November 16). *Studying, researching and teaching African indigenous knowledges: Challenges, possibilities and methodological cautions*. Retrieved June 6, 2014, from www.unisa.ac.za/news/docs/Studying_researching

Ermine, W. (1995). Aboriginal epistemology. In M. Battiste & J. Barman (Eds.), *First nations education in Canada: The cycle unfolds* (pp. 101–112). Vancouver, BC: University of British Columbia Press.

Francis, L. (2008). *Significance of animal symbolism among the Akans of Akyem Abuakwa traditional area*. Thesis submitted to the School of Graduate Studies, Kwame Nkrumah University of Science and Technology, Kumasi in partial fulfillment of the requirements for the Degree of Master of Arts in Art Education, Faculty of Fine Art, College of Art and Social Sciences.

Kearney, M. (1984). *World view.* Novato, CA: Chandler & Sharp Publishers.
Lee, H., Yen, C.-F., & Aikenhead, G. (2012). Indigenous elementary students' science instruction in Taiwan: Indigenous knowledge and western science. *Research Science Education, 42*(6), 1183–1199.
Little Bear, L. (2000). Jagged worldviews colliding. In M. Battiste (Eds.), *Reclaiming indigenous voice and vision* (pp. 77–85). Vancouver, BC: University of British Columbia Press.
Mapara, J. (2009). Indigenous knowledge systems in Zimbabwe: Juxtaposing postcolonial theory. *Journal of Pan African Studies, 3*(1), 102–112.
Mararike, C. (1999). *Survival strategies in rural Zimbabwe: The role of assets, indigenous knowledge, and organisations.* Harare: Mond Books.
Matsika, C. (2012). *Traditional African education: Its significance to current educational practices with special reference to Zimbabwe.* Gweru: Mambo Press.
Mbiti, J. (1969). *African religion and philosophy*. London: Heinemann.
McGregor, D. (2002). Traditional ecological knowledge and the two-row wampum. *Biodiversity, 3*(3), 2–3.
McKinley, E. (2007). Post colonialism, indigenoous students and science education. In S. Abell & N. Lederman (Eds.), *Handbook of research on science education* (pp. 199–226). Mahwah, NJ: Lawrence Erlbaum.
Michell, H. (2005). Nēhîthâwâk of Reindeer Lake, Canada: Worldview, epistemology and relationships with the natural world. *Australian Journal of Indigenous Education, 34*, 33–43.
Moyra, K. (2008). Science education and worldview. *Cultural Studies of Science Education, 3*(3), 587–621.
Muguti, T., & Maposa, R. (2012). Indigenous weather forecasting: A phenomenological study engaging the Shona of Zimbabwe. *The Journal of Pan African Studies, 4*(9), 102–112.
Ngara, C. (2007). African ways of knowing and pedagogy revisited. *Journal of Contemporary Issues in Education, 2*(2), 7–20.
Odora Hoppers, C. (2002). *Indigenous knowledge and the integration of knowledge systems: Towards a philosophy of articulation.* Claremont, South Africa: New Africa Books.
Peat, F. (1994). *Lighting the seventh fire.* New York, NY: Birch Lane Press.
Shizha, E. (2010). The interface of neoliberal globalization, science education and indigenous African knowledges in Africa. *Journal of Alternative Perspectives in the Social Sciences, 2*, 27–58.
Simpson, L. (2000). Anishinaabe ways of knowing. In S. Koolage, L. Simpson, & N. Schuster (Eds.), *Aboriginal health, identity and resources* (pp. 165–185). Winnipeg, MN: Native Studies Press.
Weaver, H. N. (2001). Indigenous identity: What is it, and who really has it? *American Indian Quarterly, 25*, 240–255.

FRANCIS MUCHENJE, RUTH BARBRA GORA AND
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6. INTERROGATING THE CONCEPT OF TIME AMONG THE SHONA

A Postcolonial Discourse

INTRODUCTION

Indigenous knowledge systems (IKS) cover an array of fields from anatomy through astronomy to zoology. IKS have always provided the basis of decision making in different African communities. These knowledge systems are also embedded within specific cultural contexts, thus, lending themselves a plural character. African perspectives on the concept of time are somewhat similar to those prevalent in the Western world, but the two also differ in some important respects. Western concepts of time, for example, are in some instances characterized by specificity as these extensively rely on gadgets used to measure and tell time such as clocks, chronometers and the calendar. Western time tends to be clock bound and creates a mechanical time consciousness. On the other hand, African indigenous concepts of time tend to be somewhat elastic. This is due to the presence of a wide vocabulary, in African communities, related to time that expresses time in both specific and elastic terms. In the vocabulary, there are terms to refer to both larger and smaller units of time. However, in some instances, there is an absence of specificity on the time referred to. Time, then tends to be elastic. Time, in the African perspective, can be located within a range of, say, one to three hours in the Western sense. It is important to note that the concept of time, in the former, is closely related to seasons and events in the local environment. In indigenous African communities astronomy is also related to the concept of time. Consequently, the presence of certain stars during the night is associated with certain time periods.

This chapter seeks to interrogate the African indigenous perspective on concepts of time, in general, but more specifically, from a Shona perspective. This is premised on three claims. Firstly, we posit that indigenous Africans in general and the Shona (the largest ethnic group in Zimbabwe) in particular have a concept of time; secondly, time, according to the Shona, is not 'dead' but is functional, symbolic as well as sacred. Lastly, we argue that post-colonial African and Shona society in particular has a lot to learn from indigenous African conceptions of time.

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THEORETICAL FRAMEWORK

This chapter is informed by a micro theory, which is symbolic interactionism, in this case. In terms of symbolic interactionism, human beings act on the basis of meanings that arise out of the process of interaction (Henslin, 2003; Schaefer, 2003; Macionis, Jansson, & Benoit, 2012). These meanings guide and influence subsequent interactions. Language is a significant symbol which plays an important part in human interaction as people interact on the basis of shared meaning. According to Mead in Ritzer (2009), one of the things that language, or significant symbols generally, does is call out the same response in the individual as it does in others. This implies that language is used on the basis of shared meaning. This makes human communication and interaction possible. Indigenous concepts of time are embedded in language. Different concepts of time are to be found in all languages. Mead has argued that language is a significant symbol as people use it on the basis of shared meaning (Schaefer, 2003). In the process of interaction the different concepts of time embedded in language convey shared meaning among the participants and this makes social order a possibility.

DEFINITION OF INDIGENOUS KNOWLEDGE SYSTEMS

In order to appreciate the concept of indigenous knowledge systems, it is important to discuss the concept of culture. At the very basic level, culture can be defined as a way of life for a given people. Ndura (2004) in Ndura (2006:2) defines culture as "the acquired complex knowledge that individuals and communities use to affirm and interpret the values, beliefs, customs and practices that distinguish them from other people and groups in society." Taylor in Bennet (2003) states that culture is that complex whole which includes knowledge, beliefs, art, morals, custom and any other capabilities and habits acquired by individuals as members of society. Finally, Ngara (1991) cited in Viriri (2003) says that culture is the expression of people's social activities in relation to their struggle and with human forces that threaten their survival or their way of life. Cultures are born in the struggle to survive and to conquer nature and assist in human survival. From these definitions, it is apparent that culture provides individuals with a blueprint that offers solutions in the interaction with both the physical and social environments. Culture represents people's attempts to conquer nature and come to terms with it. Indigenous concepts of time are also part of culture. These concepts provide the foundation of decision making as people deal with their environments. Matowanyika (1995) argues that culture is an important repository for knowledge gained. Therefore, indigenous knowledge systems are located within a certain cultural context and knowledge systems are also embedded within particular cultural contexts. It needs to be appreciated that culture is not homogenous even for people of the same society and this brings diversity to the fore. Thus, indigenous knowledge systems exist in plural forms in a number of societies. Chambers (1983) posits that rural knowledge and indigenous knowledge systems exist in many forms among innumerable groups of people in innumerable environments.

The importance of culture can be appreciated by considering its functions. Mazrui (1990) in Ndolera (2005) cited by Nyoni and Nyoni (2010) identifies seven functions of culture and argues that culture provides people with: lenses of perception and cognition; motives of behaviour; criteria for evaluation, a basis of identity; a mode of communication; a basis of stratification and a system of consumption and production. Indigenous African concepts of time tend to perform all the functions outlined above. Babalola and Alokan (2013) posit that Africans conceive the time concept as a socio-cultural reality in the realm of people's philosophical scholarship. Fabiyi and Oloukoi (2013) concur and state that in Africa, traditional or local knowledge is strongly linked to local culture and past experiences.

The concept of indigenous knowledge systems has been defined in numerous ways. Masoga (2007) is of the view that indigenous knowledge systems refer to knowledge and technologies around communities indigenous to a particular space and context. Nwonwu (2008) says that indigenous knowledge is essentially local knowledge that is unique to a given culture or society. Mazonde and Thomas (2007) argue that indigenous knowledge systems refer to knowledge and technologies around communities indigenous to a particular space and context. Maurial (1999) in Hart (2010) defines indigenous knowledge as people's cognitive and wise legacy as a result of their interaction with nature in a common territory. Finally, Kibuka-Sebitosi (2008) states that the ILO Convention Number 169 (1991) defines indigenous knowledge as that knowledge that is held by a people who identify themselves as indigenous to a place based on a combination of cultural distinctiveness, and prior territorial occupancy relative to a more recently arrived population that has its own distinctive culture. These different definitions of indigenous knowledge have a common theme. They can be seen as localized forms of knowledge that have provided people with solutions as they interact with their environment. In reality they are the basis for local-level decision making in virtually all aspects of human life, including agriculture, healthcare, food preparation, education, natural resource management and cultural and traditional activities (Nwonwu, 2008). The indigenous African concept of time is located in the context of indigenous knowledge systems. These concepts of time have provided solutions to challenges encountered in interacting with both the physical and social environments.

Colonialism has had a negative effect on indigenous knowledge systems (Hart, 2010; Chambers, 1983; Bhebhe, 2000; Shizha, 2013). According to Shizha (2013), the advent of colonization in Sub-Saharan Africa brought in foreign knowledges, the so-called 'scientific knowledge' that devalued IKS as unscientific, untried and untested for education and social development. In the context of indigenous concepts of time, the advent of colonialism introduced reliance on western gadgets of measuring time in the form of watches, although indigenous concepts of time are still a vital resource in a number of communities. Walker (2004) cited in Hart (2010) is of a similar opinion and states that the marginalization or blinding of indigenous worldviews has been and continues to be one of the major tools of colonization. In the context of the time concept, Babalola and Alokan (2013) posit that the

enlightened and the educated among the people see in western education, a better way of time consideration. Chambers (1983) has also observed that the colonizing force of outsiders' knowledge is programmed to override and bury other paradigms and to impose its own. No wonder some scholars have summarized the objective of colonialism as cultural imperialism.

CHARACTERISTICS OF THE SHONA CONCEPT OF TIME

Mbiti has argued that for Africans time has two dimensions: a past and a present (Beyaraza, 2000; Parker, 2006; Kalumba, 2008; Babalola & Alokan, 2013). To Mbiti, African time does not project into the future. This position is debatable given that even in terms of language, for example, in the Shona language in Zimbabwe, there is vocabulary that points into the future as will be illustrated later in the chapter. Therefore, time is a continuum, and it is the African understanding of this that enables them to conceive of both near and distant future events and live with the hope of seeing these fulfilled (Beyaraza, 2000). There is also need to underline the fact that there is a difference between Western and indigenous African concepts of time. Okembe and Imani (2012) argue that Africans collectively, and certainly historically, before the advent of the Western science narrative and discourse, did not live in the conceptual world of Eurocentric time and space. This is also clearly shown in the characteristics of the concept of time in indigenous African communities. Indigenous African perspectives on time have several characteristics. These characteristics tend to be shared with other societies in so far as time is concerned. Time is associated with events (Beyaraza, 2000; Babalola & Alokan, 2013). Events that occur in the different communities can be used as a reference point. These events also include those taking place in nature. Babalola and Alokan (2013) argue that Africans are conscious of the environment and the nature around them and reality as a whole, including the awareness of the Divine. As a result, time is tied to events that occur in the community as well as in nature. In the Zimbabwean case, in the Shona language, months of the year have certain names that are also tied to events taking place in nature. Such events signal the advent or even end of a certain time period.

It is also important to note that time is considered to be sacred. For instance, there are certain periods in the year when certain activities are prohibited. Consider the burial of a deceased person. The burial has to be conducted at a particular time. Africans have a sense of the sacred and a sense of mystery. There is high reverence for sacred places, persons and objects. Similarly, sacred times are also celebrated. For example, the seasonal cycles and stages of life are sanctified by ritual action. Rites of initiation, of purification of individuals or communities and of consecration are widespread. To Africans, life has a festive dimension and is thus celebrated in appropriate seasons or times. Among the Shona, for example, there are sacred rituals at birth, adulthood, marriage and death (Aschwaden, 1982).

A measure of time such as age is an essential part of social life. Old folk are held in high esteem to the extent of the strong belief that since they have seen more of the days (light), they are able to give direction for living in the circumstances of the present day; their wisdom is therefore regarded as prophetic (sacred). Sacredness of time in the African perspective is also observed by setting aside of days referred to as *chisi* (resting day). These are days on which members of different communities are not expected to engage in farming or burial activities. They are days of rest that give the local administrators time to transact activities, like conducting village court business and ritual activities. If a member of the community decides to deviate from this norm, one is expected to pay a fine for deviance. The choice of day to set aside as *chisi* in a community rests with the respective traditional leaders who are also highly revered. Sacredness of time from the African perspective also extends to the issue of taboos. For instance, it is taboo for one to marry or perform rituals during the month of *Mbudzi* (November) because of the thunder and lightning that might strike the gathered crowd to witness the ceremony. It is also taboo to perform orature such as children's games, folktales, idioms and riddles during summer and autumn seasons. In light of that, one can conclude that the Shona regard time as sacred. That is also reflected in some aspects of their language.

SHONA LANGUAGE AND TIME

Time is too abstract a concept to be fully grasped cognitively, thus Fulga (2012) considers the different strategies of a language to be very useful in representing time. In the same vein, Babalola and Alokan (2013) observe that the vivid use of language with reference to time is unique. It follows then that the Shona language has its unique way of conceptualizing and characterizing time. For Shona speakers, the concept of time helps to bring out their beliefs, attitudes, practices and general way of life. Their referencing of time is therefore determined by the linguistic and cultural influences these speakers are exposed to while growing up. This is buttressed by Babalola and Alokan (2013) who opine that time is a socio-philosophical conception that is part of the identity of a people. Baroditsky (2011) concurs by echoing that how people conceptualize time appears to depend on how the languages they speak tend to talk about time. For that reason, time herein is discussed in the context of the cultural thought system and language of the Shona people.

In the Shona language, time is best described as being linear and thee-dimensional, although it is also cyclic. Contrary to Mbiti's conclusion on the African concept of time, the Shona consider time in the perspective of the past, present and future. There is spatial progression from the past, through the present into the future. The Shona language has words, grammatical forms, constructions and expressions that refer directly to the three broad categories of time. These various ways of portraying time in the Shona language are explored below.

Verbal Tenses and Gradations of Time

The Shona language grammaticalizes the concept of time using tense to distinguish between the past, present and future (Mashiri & Warinda, 2010). Time reference is therefore marked on verbs using morphemic markers. Mpofu-Hamadziripi, Ngunga, Mberi and Matambirofa (2013, p. 188) note, "Tense, like many other aspects of language, originates from the extra-linguistic notion of time and its perception as operational through a lineal, forward-looking motion." In simple linguistic terms, this assertion means that time translates into what is commonly referred to as tense. In the Shona language of time, tense is bound together with the verbal morphology and/or category as Mpofu-Hamadziripi et al. (2013) assert. The verb is the nucleus around which all the other inflections or morphemes gather.

When time is mapped into the Shona language, the reference point of the tense is always now—which is the present. The backward movement of time is marked by tense signs that are a continuum of the past; the here and now of time is encoded by the present or continuous tenses, while the times ahead are represented by a continuum of future tenses (Mpofu-Hamadziripi et al., 2013). Both the past and future tenses are further characterized by two tense markers each—the near and the far. This indicates that in Shona, time is elastic since tense is not demarcated in a strict way like westerners would do using a chronometer. Rather, time and tense are used in broad terms that are widely understood by Shona speakers. Through tense marking, as mentioned earlier, the Shona language delineates time into three broad categories, namely: past, present and future. These are illustrated and explained below.

The past time has two degrees that are labelled as the recent and the remote past. The recent past refers to actions or states that would have occurred before what Mpofu-Hamadziripi et al. (2013) term the linguistic *now*. The recent past actions and states are understood to have taken place on the day of speaking or writing (Mashiri & Warinda, 2010). Such actions and states are encoded by the morphemic marker ***-a-*** as in the following illustrations:

- *Nd-**a**-taura naye* (I have spoken to her/him)
- *V-**a**-nyora bvunzo* (They have written the examination)

In contrast from the recent past, the remote past locates those actions and states prior to the day of speaking or writing. The remote past "hypothetically goes back to time infinite" (Mpofu-Hamadziripi et al., 2013, p. 190). This period of time is denoted by the morphemic marker ***-ka-*** as exemplified below:

- *Nda**-ka**-taura naye* (I spoke to her/him)
- *Va**-ka**-kanyora bvunzo* (They wrote the examination)

The present tense, as alluded to earlier, marks the linguistic *now*, which is basically the time of speaking or writing. The present tense is simply the *now*. It is denoted by the distinctive markers ***-ri*** and ***-no-*** as in the following pairs:

- *Ndi**-ri** kutaura naye* (I am speaking to her/him)
- *Va**-ri** kunyora bvunzo* (They are writing the examination)
- *Ndi**-no-**taura naye* (I speak to her/him)
- *Va**-no**-nyora bvunzo* (They write examinations)

The present tense ***-no-*** is that which Mberi (2002) cited in Mpofu-Hamadziripi et al. (2013, p. 191) refers to as the "indefinite present tense" or simply the present continuous. Besides ***-ri*** and ***-no-*** as morphemic markers denoting the present tense, Fortune (1977) also adds the present stative ***-ka-*** as another indication of the linguistic now. Fortune argues that ***-ka-*** refers to a state presently obtaining relative to the time of speech or writing. This is reflected in the following constructions:

- *A**-ka-**naka* (She is beautiful/He is handsome)
- *A-**ka**-reba* (S/he is tall)

The third gradation of time in Shona, the future tense, points at actions and states that occur subsequent to the linguistic now. Just like the past, the future time has two tense markers—the immediate future and the distant future, also referred to as the near future and far future respectively. Mashiri and Warinda (2010) concur with Mpofu-Hamadziripi et al. (2013) that the morphemic marker for the near/immediate future is ***-o-*** as in:

- *Nd**-o-**taura naye* (I am about to speak to her/him)
- *V**-o-**nyora bvunzo* (They are about to write the examination)

The distant/far future is marked by the morpheme ***-cha-*** as illustrated in the following verbal constructions:

- *Ndi**-cha-**taura naye* (I will speak to her/him)
- *Va**-cha-**nyora bvunzo* (They will write the examination)

Nominal Constructions as Adverbs of Time

Adverbs of time are strategies employed by the Shona language to indicate the recentness and/or remoteness of time. In concurrence with Chimhundu and Chabata (2007), Mpofu-Hamadziripi et al. (2013, p. 111) define adverbs of time as constructions which "… tell us when an action happens, happened, will happen or is due to happen, as well as its frequency and duration." Basically, adverbs of time are nominal constructions which answer to the question "When?" 'When' is synonymous with time. The following is a list of nouns that function as adverbs of time, some of which have been adopted and adapted from Mpofu-Hamadziripi et al. (2013):

- *nhasi/nyamashi/nyamusi* (today);
- *mangwana* (tomorrow);
- *nezuro/zuro* (yesterday);
- *marimwezuro/marumwezuro/zona* (the day before yesterday);

- *kusweramangwana* (the day after tomorrow);
- *hwedza* (tomorrow)*;*
- *makeyi* (last year).

Chimhundu and Chabata (2007) note that, seasons of the year can also function as adverbs of time still answering to the question "When?" as in:

- *muchando* (in winter);
- *muzhizha* (in summer);
- *muchirimo* (in autumn).

Figurative Referencing of Time

There is extensive employment of figurative language by the Shona in referencing time. Use of idioms and proverbs also indicates how the Shona conceptualize time. The figurative expressions below show how conscious the Shona are of time.

- *Kuita bete rawira mumukaka* (This refers to one who does not return from an assignment or journey in time).
- *Kuita kwakaenda imbwa ndiko kwakaenda tsuro* (To never return with feedback when sent to make a follow up on someone or on something).
- *Kuendera dzama semadora* (To disappear for sometime before re-surfacing).
- *Chinono chinengwe bere rakadya richifamba* (Emphasizes the importance of doing things hastily).

Events and Referencing of Time in Shona Culture

For the Shona, just as with other African people, time is also reckoned in reference to events pertaining to human beings, animals and birds (Babalola & Alokan, 2013). Time makes meaning when attached to these events as exemplified in the following Shona linguistic terms:

- *Rubvunzavaeni* (dusk)—after sunset when those who can no longer continue with their journey in the dark look for overnight accommodation at the nearest homestead;
- *Mashambanzou* (dawn)—early hours of dawn when animals like elephants 'bathe';
- *Mambakwedza* (dawn)—very early hours of the dawn when those who could not fall asleep, because of say problems, yearn for sunrise in order to solve pending issues;
- *Runyanhiriri* (dawn)—break of daylight when small nocturnal predators start hunting.

Events also govern the approximate reckoning of months as every month of the year has been named to make it convenient for the Shona to identify time

in relation to events that are popular in and/or unique to the particular month. Consider the months of the year and their corresponding activities tabulated below:

Table 1. Activities by month

Month	*Characteristics, activities and their significance*
Ndira (January)	Characterized by the appearance of very small insects, called *ndira*, on rocky surfaces and diminishing food reserves.
Kukadzi (February)	Believed to be a month when women *(vakadzi)* get the crops that ripen first and cook without their husbands' knowledge.
Kurume (March)	Men *(varume)* frequent forests for honey and wild fruits.
Kubvumbi (April)	Local weather is characterized by mist, fog and incessant rainfall.
Bandwe/Chivabvu (May)	Signs of the incoming winter season.
Chikumi (June)	The middle month.
Chikunguru (July)	Cold month when people sleep near the fire to warm themselves.
Nyamavhuvhu (August)	The weather is windy *(kuvhuvhuta)*.
Gunyana (September)	The month when birds begin to lay eggs and have nestlings.
Gumiguru (October)	Is the tenth month *(mwedzi wechigumi)*.
Mbudzi (November)	Marks the gestation period of goats *(mbudzi)*.
Zvita (December)	Month of thanksgiving for the year (*mazvita)*.

The names of months continue to live within the minds, literature and vocabulary of the Shona people throughout the year. Similarly, there are some years known for some particular happenings, especially natural disasters such as:

- *gore renzara*—a year that saw people experiencing severe drought and famine;
- *gore rehwiza*—a year characterized by an infestation of grasshoppers;
- *gore retungundu*—a year when there was an outbreak of anthrax;
- *gore remhezi*—a year of an extensive outbreak of scabies.

The naming of seasons can also be attached to the referencing of time in relation to habitual events. However, for purposes of avoiding unnecessary repetition, in this chapter seasons have been treated as part of nature in the next section.

Nature and Referencing of Time

Languages co-opt representations of the physical or natural world in order to mentally represent time (Baroditsky, 2011). In light of that, the Shona concept of time can be

realized through naming of the different seasons of the year. The next table shows seasons and the corresponding activities as dictated by natural phenomena, namely, weather and climate.

Table 2. Activities by seasons

Season	*Activities and their significance*
Zhizha/Munhuruka (Summer)	• Abundance (*zhizha)* of self-growing edible but wild vegetables like mushrooms and okra. • Experiencing heavy rainfall (*kuturuka*).
Masutso (Autumn)	• Plenty (*kusutsa)* foodstuffs from fields.
Chando (Winter)	• Cold (*chando*) weather.
Chirimo (Spring)	• Fields lie fallow while people rest.

Time is tied to seasons and day-to-day activities as dictated by the weather and climate. The simple observation of natural phenomena is also significant in referencing by the Shona. There are certain environmental occurrences that point at specific times of the year. Consider the following:

- *nguva yepfumvudza* (when trees grow new leaves, spring foliage);
- *panobuda ishwa* (marks the emergence of flying termites);
- *panouya nyenganyenga* (characterized by the arrival of swallow birds);
- *panoonekwa mashuramurove* (characterized by arrival of the stork bird)
- *panomera hohwa* (time of widespread shooting/appearance of mushroom).

Astronomy and Referencing of Time

Astronomy is the study of the universe and objects in it, including the moon, stars and sun. The Shona reckon time through the movement and position of the sun, moon and stars. With specific reference to the sun, Mpofu-Hamadziripi et al. (2013) observe that Shona language has distinct words for the different degrees of light during the dawn, midday and dusk periods namely:

- *Mangwanani* (morning)
- *Masikati* (afternoon)
- *Manheru* (evening)

This reflects time-keeping practices that use the sun relative to the horizon, basing on the observation of the shadow. This strategy is quite scientific.

While during the day reference is made to the position and movement of the sun, during the night, time is similarly referenced using the state, movement and position of the moon as in:

- *mwedzi uchiri mutete* (newly formed moon);
- *mwedzi uchangobuda* (moonrise);

- *mwedzi wanyura* (setting of the moon);
- *mwedzi waora* (eclipse of the moon);
- *mwedzi wagara* (new moon).

Similarly, the Shona also use specific stars to demarcate certain time periods of the night. For instance, *vhenekeratsvimborume* (evening star) is a star that appears around 2100 to 2200 hours to enable senior bachelors to search for or prepare foodstuffs for supper, while *nyamatsatsi* (morning star) appears around 0400 hours early in the morning.

Time and Agedness

In this last section of our discussion, we focus on time and agedness. In other words, we present time as a measure of one's chronological age which is calculated in years. By agedness in this discussion is meant *kukura* or *kuve munhu* (being mature). It is important to mention at the onset that ordinarily and especially in Western parlance, one's age refers to the number of years one has accrued whilst alive. Thus, one's age determines whether or not one is an adult. Further, concomitant with one's age are responsibilities and obligations such as voting, marriage or entering into other contracts. On the basis of this framework, one's adulthood is measured exclusively by one's age. Accordingly, the moment one reaches a particular age, for instance age 18 or 21, it invariably differs from society to society, one automatically is regarded as an adult, in other words, *ave munhu mukuru* (coming of age).

However, from an indigenous or traditional African perspective, Western-measured chronological age is considered as misleading. This is because according to the indigenous Shona, age defined as time one has been alive does not quite translate into one's adulthood. In other words, it is not the number of years one has lived that determines agedness or adulthood, but rather and very importantly, the quality of life. By quality of life, in this discussion, is meant one's *tsika* (behavior or manners) as determined by the community one is domiciled in. Thus, among the indigenous Shona, when they ask how old one is, usually the response is, *ava munhu* (he/she is now a person). It is essential to note that both the question and the response are both loaded and ambiguous, especially to 'outsiders'. They can be considered as such because firstly, regarding the stated question, it is not quite age as in chronological age which is the issue, but rather the type and nature of responsibilities one can shoulder. Secondly, the response sounds contradictory because what is meant is not that the individual concerned was not a human being before and has suddenly become one. Rather, what is being meant is that he/she is now a responsible person. In other words, it is not age as in the number of years one has that matters, but rather the responsibilities one can shoulder. Furthermore, it is not exclusively chronological age that determines one's age but rather one's level of *tsika* (behaviour) and responsibility as perceived by the family and community. Consequently, it is conceivable among the Shona to find some so-called adults who

may spend the rest of their lives being regarded as *vana* (children). These are adults who are usually sent to go and skin goats when other adults, usually men, are discussing serious issues of the village (*musha*). Being sent away to do such trivial tasks is an indication that the person is considered immature, not chronologically, but mentally. In addition, his contributions are considered as immature and inconsequential. What is important to note is that whilst these individuals are chronologically advanced in terms of numbers of years, they are still considered as immature or as overgrown children who cannot make meaningful contributions to family or village matters.

Furthermore, it is also conceivable among the Shona for a teenager to be considered an adult (*ave munhu*) (Gelfand, 1973). This is not withstanding the fact that chronologically, he/she may be considered a minor. Such a consideration is based largely on the nature of responsibilities he/she can shoulder even though ordinarily being considered a minor. It is instructive that among the Shona, age apart from being a social construct has epistemic as well as metaphysical or spiritual value and symbolism. Thus, according to the indigenous Shona people, the elderly were highly revered in their families as well as the society at large. This is unlike in the contemporary world where they are sometimes confined to 'homes'. We argue that agedness is highly respected because we believe that they are considered as invaluable depositories of wisdom and infallible knowledge, and they were sources of advice and information, hence were considered indispensable. African people, including the Shona, believed that old age was associated and accompanied with wisdom and understanding of the world and it was the duty of the elderly to instruct the youth in socially accepted manners or behaviors. Accordingly, the community was expected to respect them.

Secondly, they were highly respected because they were considered to have metaphysical links between the world of the 'living' and that of the 'living dead' (*vadzimu*). They were considered to be facilitators of dialogue between the physical and the spiritual realms. In view of this, their role and place was not to be compromised. This view leads us to another related issue which is very important to the Shona, notably, the notion of *presence* associated with *agedness.* In further elaborating the issue of *presence* as being crucial to the Shona order of things, it is interesting to note that the 'aged' could be very old to the point that they no longer make sound and logical contributions. In spite of that their presence is still considered crucial. For instance, one of the authors had an experience whereby a marriage function (*kuroorwa kwemwanasikana*) had to be delayed until *mbuya vemusikana* (the girl's grandmother) had come. Unfortunately, because she was very old, in her late nineties, she had to be carried in an ox drawn scotch cart (wagon). As soon as she arrived she was given a cup of tea with bread and jam, she asked for a mat (*rukukwe*), and in no time she was asleep. The people who were there to witness the ceremony did not bother about her being asleep on her arrival. They were actually happy that at least she had arrived and therefore the business of the day, *kuroodza,* commenced "with" her, but "without" her because she was asleep.

What is noteworthy from the above is that the importance of the aged or the elderly is not in their contributions, to which they may not make any. Their importance is in their *presence*, which has a metaphysical significance from the Shona perspective. This is because the elderly, in so far as the indigenous Shona are concerned, are considered as a link between the physical world of the living and the metaphysical or spiritual world of the "living-dead" (*vadzimu*) (Mbiti, 1975). To that end, we present agedness as a sign of having lived longer and experienced many things, and not as a "curse." Age is seen as a blessing firstly to the individual concerned, and secondly to the family and community. Furthermore, according to the Shona, age is not so much about the length of time one has been alive or the number of years, but rather the quality of life one has lived. Essentially therefore, we present age according to the indigenous Shona as time which has a social, epistemic as well as metaphysical or spiritual significance.

CONCLUSION

This chapter has shown the utility of IKS. Whilst there are similarities between western and indigenous African concepts of time, a number of differences have been noted. Events in the physical environment are closely linked to the concept of time. For Africans, and the Shona in particular, time is sacred. There are certain activities that are prohibited during certain times of the year as this violates taboos. A relationship between aging and time has been demonstrated in this chapter. The elderly in Shona society are highly valued due to the wisdom that they possess. The concept of time is embedded in the context of IKS.

REFERENCES

Aschwaden, H. (1982). *Symbols of life: An analysis of the consciousness of the Karanga*. Gweru: Mambo Press.

Babalola, S. F., & Alokan, O. A. (2013). African concept of time, a socio-cultural reality in the process of change. *Journal of Education and Practice*, *4*(7), 143–147.

Baroditsky, L. (2011). How languages construct time. In S. Dehaene & E. Brannon (Eds.), *Space, time and number in the brain: Searching for the foundations of mathematical thought* (pp. 333–342). San Francisco, CA: Stanford University Press.

Bennet, C. L. (2003). *Comprehensive multicultural education*. Boston, MA: Pearson Education.

Beyaraza, E. (2000). *The African concept of time: A comparative study of various theories.* Kampala: Makerere University Press.

Bhebhe, N. (2000). Colonial stultification of African science and technology and the abuse of African culture. In E. Chiwome, Z. Mguni, & M. Furusa (Eds.), *Indigenous knowledge and technology in African and diaspora communities: Multidisciplinary approaches* (pp. 7–15). Harare: Southern Africa Association for Culture and Development Studies.

Chambers, R. (1983). *Rural development: Putting the last first*. Essex: Longman Scientific and Technical.

Chimhundu, H., & Chabata, E. (2007). *Duramazwi redudziramutauronouvaranomwe*. Gweru: Mambo Press.

English, P. (2006). Kalumba, Mbiti: A traditional concept of time. *Philosophia Africana*, *9*(1), 53–56.

Fortune, G. (1977). *Elements of Shona*. Harare: Longmans.

Fulga, A. (2012). Language and perception of space, motion and time. *Concordia Working Papers in Applied Linguistics, 3*, 26–37.

Hart, M. A. (2010). Indigenous worldviews, knowledge, and research: The development of an indigenous research paradigm. *Journal of Indigenous Voices in Social Work*, *1*(1), 1–16.

Henslin, J. M. (1998). *Essentials of sociology: A down to earth approach*. Needham Heights, MA: Allyn and Bacon.

Kalumba, K. M. (2008). *Kagame and Mbiti on traditional Bantu view of time*. Retrieved May 12, 2014, from www.cavehilluwi.edu/the/histphil/chips/archieves/2006/docs/kalumbaii.aspx

Kibuka-Sebitosi, E. (2001). Protecting indigenous knowledge and the rights and interests of indigenous medical practitioners in Africa. *Indilinga, 7*(1), 72–86.

Macionis, J. J., Jansson, S. M., & Benoit, C. M. (2012). *Society: The basics* (Fifth Canadian Edition). Toronto: Pearson/Prentice Hall.

Mashiri, P., & Warinda, C. (2010). *Dudziramutauro*. Gweru: Mambo Press.

Masoga, M. A. (2007). Contesting space and time: Intellectual property rights and indigenous knowledge systems research challenge. In I. Muzonde & P. Thomas (Eds.), *Indigenous knowledge systems and intellectual property in the twenty-first century: Perspectives from Southern Africa* (pp. 3–11). Dakar: CODESRIA.

Matowanyika, J. Z. Z. (1995). What are the issues on indigenous knowledge systems in Southern African: Some issues of relevance in timing indigenous systems to sustainable resource management in Southern Africa. In J. Z. Z. Matowanyika, V. Garibaldi, & E. Musimwa (Eds.), *Indigenous knowledge system and natural resources management in Southern Africa* (pp. 51–61). Harare: IUCN.

Mazonde, I., & Thomas, P. (Eds.). (2007). *Indigenous knowledge systems and intellectual property in the twenty-first century*: *Perspectives from Southern Africa*. Dakar: CODESRIA.

Mpofu-Hamadziripi, N., Ngunga, A., Mberi, E. M., & Matambirofa, F. (2013). *A descriptive grammar of Shona*. Harare: Sable Press.

Ndura, E. (2006). Reflections of teacher's culture in the classroom: Beginning to see and hear. *Electronic Magazine of Multicultural Education*. Retrieved November 5, 2014, from www.eastern.edu/publications/emme/2006fall/Ndura.pdf

Nyoni, T., & Nyoni, M. (2010). The 'culture hut' concept: A case study of Danda and Chimedza schools in Zaka District. *Journal of Sustainable Development in Africa*, *12*(1), 146–158.

Nwonwu, F. (2008). Using indigenous knowledge in traditional agricultural systems for poverty and hunger eradication: Reflections on prospects in South Africa. *Africa Insight*: *Development through Knowledge, 37*(4), 46–60.

Okembe, R. A., & Imani, N. (2012). The implications of Africa-centered conceptions of time and space for quantitative theorizing: Limitations of pragmatically-bound philosophical meta assumptions. *The Journal of Pan African Studies*, *5*(4), 101–111.

Ritzer, G. (2009). *Sociological theory*. New York, NY: McGraw Hill.

Schaefer, R. T. (2004). *Sociology: A brief introduction*. Boston, MA: McGraw Hill.

Shizha, E. (2013). Reclaiming our indigenous voices: The problem with postcolonial sub-Saharan African school curriculum. *Journal of Indigenous Social Development*, *2*(1), 1–18.

Viriri, A. (2003). *Language planning in Zimbabwe: The conservation and management of indigenous language as intangible heritage.* Retrieved April 26, 2012, from www.international.icomos.org/victoriafalls2003/papers/C1-5%20Viriri.pdf

MATHIAS SITHOLE

7. INDIGENOUS PHYSICS AND THE ACADEMY

INTRODUCTION

Contributions made by Africa and its people to history and civilization are conspicuously missing from textbooks for formal education and remain unknown to many (Ngara, 2007). It is against this background that the various aspects of indigenous physics knowledge systems should be resuscitated. This chapter analyzes some aspects of the indigenous physics knowledge systems (IPKS) and argues that IPKS did not die as a result of colonial conquest (Mapara, 2009). Further, the chapter's thrust is to heighten awareness, stimulate new thoughts and generate discussion on the wealth of IPKS as such. The analysis in this chapter is divided into four parts. The first part is an introductory analysis of what physics as indigenous knowledge is all about in relation to definitions of *physics* and *indigenous*. The second part explores the characteristics of indigenous physics, while the third section examines the existence of physics education, the methods of physics knowledge transfer, and development in indigenous African societies. Part four looks at the rationale for including indigenous physics into science education in schools. Finally, the chapter is summed up by making a conclusion to issues raised.

PHYSICS AS INDIGENOUS KNOWLEDGE

The discussion of indigenous knowledge systems (IKS) has recently taken different dimensions and scope. However, for the sake of analytical tidiness and rigor, this chapter limits its analysis of IKS to a specific type or manifestation, namely the existence of IPKS as well as its academic developmental role in the past, in the present and, by all means, in the future. Indeed, the analysis is further limited to the narrow issue of norms and practices regulating the acquisition, use and transfer of IPKS. Knowledge of 'physics' and its methods of investigation cannot be divorced from a people's history, cultural context and worldview (c.f. Shizha, 2014). Societies acquire physics concepts through their cultural values and norms. This construction of cultural physics is based on the historical and cultural worldview that shapes the people's consciousness, which in turn forms the theoretical framework within which knowledge is sought, critiqued and understood (Young, Longboat, & Kulnieks, 2013). It is indeed most gratifying to see that some African scholars (Shizha, 2013; Tanyanyiwa & Chikwanha, 2011; Mapara, 2009; Pence & Nsamenang, 2008; Mkabela, 2005) have taken on the important yet daunting task of making science

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and knowledge relevant to the African realities, and criticising the Western theories and constructs that marginalize IKS and methodologies. The theories include those related to knowledge acquisition, readiness of the mind to assimilate the information as well as the methodologies used to transfer information from generation to generation.

The first term that warrants defining in this chapter is 'physics'. Physics involves the study of matter and energy in its different forms, and the transformation of matter and energy. It involves the study and understanding of the physical world and the relationship between the natures of energy and matter. Some examples of concepts in physics include forces, friction, buoyancy, cosmology, string theories, quantum theories, materials and cooling systems. All these are aspects of nature in which human beings exist as well as co-exist. The second term, 'indigenous', refers to being grown or produced in a locality. The indigenous aspects could refer to the customs or homemade tools available in and benefitting a society at a particular time. Therefore, indigenous knowledge involves experiential knowledge and addresses diverse and complex aspects of indigenous peoples and their livelihoods, taking into account their cosmos, spirituality, ontological realities, land, socio-cultural environment and historical contexts (Shizha, 2013). The discussion narrows on various forms of the nature of experience, the methods of knowledge transfer, and the pull and push factors for having such knowledge, one of which is survival. It is within these contexts that the three key terms, indigenous, physics and academy, are taken. Academy, in this sense, refers to schools, colleges and universities.

THE CHARACTERISTICS OF INDIGENOUS PHYSICS KNOWLEDGE

It is crucial at this stage to discuss the characteristics of indigenous physics. According to Mkabela (2005), indigenous knowledge systems are the complex set of knowledge and technologies existing and developed around specific conditions of populations and communities indigenous to a particular geographical centre. Indigenous physics or science, here used interchangeably, is experiential knowledge based on a worldview and culture that is basically relational. Indigenous physics may also be perceived as a way of knowing and a way of life. For that reason, the power of indigenous science seems to lie in its ability to make connections and perceive patterns across vast cycles of space and time (Worldwide Indigenous Science Network, 2013). Everyday experience indicates that indigenous science relies upon direct observation for forecasting and generating predictions. Unlike Western science, the data from indigenous science are not used to control the forces of nature. Instead, they tell us the ways and the means of accommodating nature. Again, the purpose of indigenous science is to maintain balance – balance between cold and heat and balance between biotic and environmental factors.

In addition, indigenous science is concerned with relationships. This entails the relationships between the environment and members of society. In other words, society succumbs to the dictates of the environment so as to continue surviving and to avert

death. Shizha (2008) argues that indigenous science is holistic as it draws on all the senses, including the spiritual and psychic. Therefore, a holistic understanding of IKS should uphold an integrated perspective that includes both the spiritual and material aspect of a society as well as the complex relationship between them (Mkabela, 2005). For this reason, it causes people to remain embodied in the natural world. In addition, Shizha (2008) and Mapara (2009) indicate that indigenous knowledge is the local knowledge, knowledge unique to a given culture or society. From this analysis, indigenous knowledge is the information foundation for the public. IKS are dynamic and are continually influenced by internal creativity and experimentation as well as by contact with external systems. There has been improvement in the various forms of technology because people have the inherent behaviour of comparing things when they interact with others. Mawere (2014) argues that indigenous knowledge is part of the lives of indigenous people and their livelihood depends almost entirely on specific skills and knowledge that is essential for their survival. IKS are rooted in traditional systems of beliefs, which indigenous people use to understand and interpret their biophysical environment (Laccarino, 2003). Laccarino is also cognisant of the value of indigenous science when he states that, "…science is part of culture, and how science is done largely depends on the culture in which it is practiced" (2003, p. 221). He further observes that indigenous knowledge embodies a wealth of wisdom and experience of nature gained over millennia from direct observations, and transmitted, most often orally, over generations.

The need for economic and physical survival has been identified as great motivating forces for technological advancement (Clark, 1997). Indigenous physics-based knowledge is generated in order to solve societal and natural challenges. Therefore, indigenous or conventional physics is meaningless unless it solves societal problems. Notions of physics have been there from time immemorial. For that reason, no one can claim to have generated the knowledge of physics and passed it on to other societies (Mapara, 2009). It was available to all societies in different forms and stages of advancement because every society faced life challenges in areas such as weather changes, shelter, communication, food, diseases and war, among others. However, it could have been perfected by different societies because of their advanced technologies. This chapter argues, through citing several examples and scenarios, that the notion of present-day physics, taught in educational institutions, existed in African society and many other societies prior to its formalization. It makes academic sense to use the locally understood physics concept, indigenous physics, to develop the conventional laboratory-based physics concepts. This chapter aims to illustrate how physics teachers and lecturers can draw on indigenous African knowledge as they teach concepts and introduce terminologies in the school physics curriculum.

INDIGENOUS PHYSICS AND METHODOLOGIES OF KNOWLEDGE TRANSFER

Indigenous physics knowledge systems manifested themselves in various forms. The knowledge transfer was done both orally and practically. What follows is a

synopsis of the discussion of objects that depicted physics concepts in indigenous African societies. During pre-historical times, indigenous people used bows and arrows to hunt for wild game and defend themselves in times of war. The shape of the arrow shows a high level of physics. The feather attached gave direction to the arrow. The curved shape of the bow that was there to withstand compression forces shows aspects of strength and speed. The string of the bow was chosen to resist tension forces. There is a very interesting physical phenomenon in the physics behind archery, known as Archer's paradox (Miyazaki et al., 2013). When an arrow is released to the left (or right) of a bow and is deliberately aimed off target, it will straighten out during release and hit the target. Hence in order to hit the intended target, hunters would deliberately aim away knowing that the arrow would straighten out. Though they learnt this from experience, they still managed to display profound knowledge of the Archer's paradox. The bow and arrow as well as the archer can be used to teach physics concepts and be well understood by many learners.

Physics concepts like acceleration, force and gravity, among other related concepts, can be best understood through use of the bow and arrow. The concept of bow and arrow was deliberately and orally passed from generation to generation for certain reasons. Thus, indigenous physics was taught so that learners would continue to maintain their societies effectively (Sabinet, 2015). Equally important, is to note that great research occurred towards improvement of the bow and arrow. Users of such technology kept on sharpening their skills to make the bow and arrow better in both performance and durability. Indeed, the world needs to revise its impression that one can only be a researcher if one has undergone formal education because:

> We are all born researchers; research is the creating element that runs through our minds, bodies and feelings to guide, protect, and assist us to move to the next level of creation. Without research, human beings would quickly or slowly approach their extinction. (Mji, 2009, p. 9)

Spears were normally used in tandem with bows and arrows to aid in both hunting and war. The two most important factors involving the physics of throwing a spear are the centre of gravity and centre of pressure. The centre of gravity is near the grip and does not change during throw. Master hunters learnt to utilize these concepts and attack angles to produce the maximum spear distance with greatest impact. Throwing at the optimal attack angle (LaBudde, 1999) is throwing the spear at the angle at which the air flows most efficiently around the spear. To produce maximum distance, the spear must be thrown at the attack angle to minimize drag and maximize lift and speed. The attack angle for throwing in a head wind is slightly more down causing less lift than when a spear is thrown into a tailwind. According to McGrath (2010), children acquire science concepts through enquiry into the proper use of the spear. On the other hand, he sees science as a process of identifying properties, discovering relationships and searching for answers.

The catapult was made up of a piece of hide attached to string (as illustrated in Figure 3). It was used to throw stones at a tangent after a circular motion. Today circular motion appears as a physics concept. Uniform circular motion is motion along a circular path in which there is no change in speed, only a change in direction (Tippens, 2007). The concept of catapult was again passed on from generation to generation. For that reason the catapult physics concept became a life science. According to Ginsburg and Golbeck (2004), science involves life science (study of living things, plants, animals, earth and space), study of the earth, sky, oceans, and physical science (study of matter, form and change). All these concepts are learned when children observe, explore and experiment in their environment (both at home and in school). Making and using a catapult was and still is applying the knowledge of physics by African indigenous children, a practice that has existed for many years.

Communication challenges introduced mouth whistling. The mouth was slightly closed to produce sound. The whistle was used as both call and alert signals to each other. Dogs made howling sounds if lost. The shepherd gave direction to animals through a whistle. The drum made of animal hide was used to give signals of impending events such as war and important meetings. People knew how to give variance to its loudness. The drum has been used all over the world as a means of communication and self expression. Its broad variety of users includes the early Africans who used them for ceremonial purposes.

Drums use the physics concepts of waves and resonance. Resonance (the reinforcement or prolongation of sound by reflection from a surface or by the synchronous vibration of a neighboring object) plays a major role in the design of musical instruments as well as in the sensitivity of our ears to different frequencies of sound (Newman, 2008). However, for a closed-end instrument such as a drum, the sound waves are different. A lot of the energy is dissipated through the shell of the drum, which is the reason for the variance in drum construction these days. Many different kinds of wood are used to generate different sounds, or a different amount of energy absorption. The heaviest wood that dissipates the most amount of energy is oak, creating a lower, flat sound. Such observations support the view that indigenous knowledge is expressed in a variety of ways, including stories, legends, folklore, rituals, songs, games and even laws (Nyota & Mapara, 2008) in which the science of drums was applied. Sticks and logs were beaten as musical instruments at traditional dances. When a song was started, women with their light voices, men with their deep voices and children with their soft voices, joined in the song. The result was a perfect natural combination of voices. Music was formed and drums would accompany the singing and dancing. Through observations, imitations and practice, such knowledge of physics used in the making of the drum was passed on from generation to generation even though it was not in written form. Again, some indigenous people clapped their hands and stamped on the ground heavily to produce sound during traditional dances in tandem with the rhythm of the drum. Here, physics knowledge is seen to be disseminated through a hands-on approach—as well as being organized in a systematic way.

Friction has been used for many generations by indigenous people. Although normally friction is viewed negatively, it actually has some important uses. Since friction is a resistance force that slows down or prevents motion, it is necessary in many applications where you might want to hold items together or prevent slipping or sliding. Friction refers to:

> a set of interfacial mechanisms that, when acting together in an interface, produces a characteristic resistance to sliding. Examples of friction processes include wear debris layer formation, surface roughness changes due to fatigue and fracture, the formation of a friction polymer, and localized adhesive transfer of material from one surface to another. More than one process can operate simultaneously to produce variations in macroscopic (measured) friction force. (Salomon & Mendeleev, 2009, p. 156)

While friction causes wear on surfaces as they rub against each other, it generates heat. Before the discovery of fire, people rubbed their hands to generate heat needed for warmth. Thus, friction was at play. Heat was also felt in other instances like when two stones hit each other at an angle and sparks were produced. The fire discovery came as a result of a great need for warmth. Indigenous people rubbed sticks together to generate fire. It was one of the solutions to the challenges of the changing weather. Eventually the need to roast and cook different types of food arose and fire was used. Society knew that somehow friction had to be addressed. The use of rollers was common in different societies and was done to move goods from place to place. Barks were removed from wooden poles used as rollers to reduce friction and increase mobility. Other objects were roughened to increase the grip. Thus, the soles of wooden shoes were engraved so that they could grip when a person moved. Experiences in science are uniquely suited to the development of thinking and problem solving skills. Thus, the mastering of fiction engaged both the thinking and problem-solving cognitive processes. Furthermore, it can be argued that the seemingly indigenous physics educators assisted their learners to construct understanding by providing the necessary raw materials such as time, space, equipment and experience. The same appears to be true in western physics methodologies.

Africans knew that food in their natural states could not last forever. Meat and vegetables were sun-dried to avoid decay. Thus they knew that moisture had to be evaporated to preserve food. People required body- building food such as protein. They knew protein had to come from animals and so they devised trapping devices or deadfall traps (*mariva*). The "riva" was used to trap mice, birds and lizards. The "riva" illustrates the concept of levers and did not come from outside indigenous communities; it was knowledge created from within. The idea was to support the survival of members of the community with protein. It was imperative to inculcate and support such indigenous physics knowledge for the benefit of members of the society.

Science teachers should use this indigenous physics to support learners as they move to higher levels of understanding through being engaged in learning

experiences (McGrath, 2010). The acquisition of such knowledge is interactive physics pedagogy. According to McGrath (2010), scientists such as Albert Einstein believed that in teaching science, learners must interact with materials, collect data and make some order of that data in what they call the learning cycle. The science of setting up *mariva* assists in the learning of physics in meaningful and familiar ways, what Stavy and Tirosh (2000) describe as learning and gaining science knowledge through naturalistic experiences. *Mariva* are an example of indigenous technology that applies physics. Indigenous technology here refers to the production of materials or goods by the people within their community. The need for economic and physical survival has been identified as great motivating forces for this technological advancement (Clark, 1997).

Measurement was important to indigenous African people, although it was not as precise as in contemporary societies. The hand and pace count were used to determine the size of quantities and the size of fields, respectively. The same principle can be used to develop physics concepts such as estimated calculations and measurements. Such societal-based methods of recording measurements were learnt in an informal way. According to Mulligan (2003), informal learning experiences are initiated by the adult. Such a method of imparting indigenous physics can assist the learner to acquire more complex physics concepts. Therefore, the physics educator needs to understand how learners think, learn the concepts, use this information in the planning and structuring experiences for students' learning and in evaluating learning (Clements, 2001). For example, the construction of local houses involved measurement and the knowledge of shapes as well as colours. Measurements were utilized to determine the length of poles for the roof and the amount of thatch needed to cover the roof.

Knowledge of texture and colour were also important in building local houses and other activities. People chose specific soil types to smear their floors and walls. Coloured soils were used to paint houses, human faces and wooden plates. Colour is a physics concept and the use of it was known to bring out beauty. Plant extracts as well as dried ground tree barks of different colours were used to tint baskets, mats and wooden items used in the kitchen. The rock paintings seen in national museums and shrines give evidence of such pre-historic existence of indigenous physics in specific societies. People knew how to use this and the occasions appropriate for their use. According to Vygotsky (1978), learning is situated within a particular culture and society which enables knowledge to become contextually defined and relevant. To this end, the utilization of IKS in physics would contribute immensely to the development of the learners, as content should be culturally relevant, (Shizha, 2014).

Mechanical structures featured prominently in indigenous African lives. To climb higher and reach objects beyond their reach, people made ladders from poles collected from their natural environment. Nature provided them with all their resources for sustainable livelihoods. The pole ladders were placed at an inclined angle. Thus, people reasoned that at an inclined angle less effort was used. People moved objects from place to place to make way for cultivation and settlements. The lever idea

was used. The lever concept was also used to remove water from deep rivers and wells. Here less effort was used to lift heavy loads. Although such information can be infused in physics laboratory lessons, research indicates that formal education in some African countries, including Zimbabwe, is undervaluing the importance of knowledge the indigenous people hold (Shizha, 2007). In addition, studies have further acknowledged the complexities involved in incorporating indigenous knowledge in the school curriculum (Shizha, 2006, 2007, 2008, 2013). The reason is that indigenous knowledge is often oral and not written, is not easily 'measurable', and has been mistaken by many as being simplistic and not amenable (agreeable) to systematic scientific investigation (Emeagwali, 2003).

The transmission of heat and cold involves physics. The grass-thatched house is cool inside during the hot weather. Grass is a poor conductor of heat. The grass, piled on each other, does not allow water to pass through during rainfall. When people suffered from the cold, the treatment was to cover the head with a mat, and a hot stone was placed inside a pot with very hot water. The idea was to produce steam which could raise the body temperature of the patient. This resulted in dilation of blood vessels and blood began to flow fast. The patient got a relief. Again, the steam breathed in opened the air passages and killed the bacteria found in the air passages. It had a healing effect too. These scientific methods which were effective for indigenous African people were undervalued by westerners who colonized Africa. Westerners ended up imposing their own indigenous knowledge on the local people and thus displaced the local people's existing knowledge (Hewson & Ogunniyi, 2011). For this reason and many others, indigenous physics, including notions of gravity, have not been prominent in school science discourse.

The idea of gravity was observed in African society as in many other societies. People knew that if an arrow is shot upwards, if a stone is thrown upwards, if a fruit detaches from a tree branch and if a person jumps upwards, sooner or later, the destination is the ground. It was insignificant to understand that all objects were pulled down by the force of gravity. They knew that the lighter the object was the more time it remained in the air. Thus the arrow was made narrow. Pieces of logs used to hit the fruits and animals on tree branches had to be made as light as possible. Additionally, people observed the water flowing from high ground to low ground by means of gravity. Such was indigenous physics. It is, however, correct to observe that there are several pitfalls in indigenous physics. The mathematical rigour needed in the further illustration of physics concepts was absent.

One of the reasons the development of physics in many societies has been slow is the seemingly imposed abstraction by conventional physics. Learners are obliged to follow a formulaic physics perception. In view of such illustrated examples, it is doubtless to conclude that indigenous physics has a role to play in conventional physics. The reason is that indigenous physics increases and broadens learners' abilities to be innovative, imaginative and creative. Nevertheless, Horsthemke (2008) appears to suggest that such indigenous knowledge involves at best an incomplete, partial or, at worst, a questionable understanding or conception of knowledge;

and indigenous knowledge is largely inappropriate. This implies that indigenous knowledge such as physics is incomplete without western knowledge.

RATIONALE FOR TEACHING INDIGENOUS PHYSICS IN SCHOOLS

What becomes apparent is the amazing resemblance between indigenous physics and some of the insights that are emerging from modern physics. There is a congruence that is as enlightening about the physical universe as it is about the circular evolution of man's understanding. Physics teachers can draw on indigenous African knowledge as they teach concepts and introduce terminology and nomenclature in the physics curriculum (Abiodun, 1998). The question often asked is: What is indigenous physics? The answer to this question is that it is locally acquired (both non-western and western) physics notions that are used by any society for their livelihoods. However, one can argue that physics is physics, no matter in which society or culture it is used. Sadly, in the contemporary world, academic physics in the academy must comply with the "international standards" of the international community. These so-called international standards based on hegemonic and Eurocentric definitions, theories and methodologies are inappropriate for indigenous African students and their communities. However, students are made to internalize the belief that to compete in the global job market they must learn the universally appropriate, acceptable technology and engineering. Thus they need to be taught Western physics and not indigenous physics, despite similarities in the scientific principles involved in both.

The 'native' (local and societal oriented) physics has been mistakenly associated with 'cultural' physics. This perspective ignores that culture permeates everything we do. According to Ngara (2007), indigenous knowledge system complexities are found in the community ceremonies and rituals which include story-telling, proverbs, folktales, recitation, demonstration, sport, epics, poetry reasoning, riddles, praise songs, word games, puzzles, tongue-twisters, dance, music, and other education-centred activities. This includes physics concepts taking into account the integrated nature of knowledge that the society acquires and transfers. Within a constructivist approach to learning physics, prior knowledge has been found to underpin learning in a significant way—either as a hindering or helping factor. It is hindering in the sense that one can feel crippled in the quest to indigenise Western-acquired knowledge and skills within the African cultural context (Nsamenang, 2006). Again, the tendency to adhere to Western tools and methodologies in African research could be one hurdle in the process of indigenisation and integration (Shizha, 2007). Educators should take into consideration, when planning, what indigenous physics to teach to learners as requisites to the acquisition of western and internationally recognized physics. Examples of the application of principles of physics should be taken from both western and indigenous contexts.

Equally significant, is what research has shown. One key issue that accounts for effective learning of physics in Africa has been the controversial status of prior knowledge that learners bring into the classroom. When they come to school, they

bring with them knowledge about what they will be taught. Hence, to say that Africans had no sense of education and therefore no education is not only a mockery but also a gross misrepresentation of facts (Mapara, 2009). African indigenous education had utility value as illustrated by the physics knowledge utilized in the application of catapults, spears and *mariva*. Youngsters were taught skills such as hunting, fishing, fish traps, and hoe-handle making. Nevertheless, Mapara (2009) further acknowledges the significance of Western knowledge by arguing that indigenous knowledge system researchers must not negate existing Western methods of investigation nor polarise it in outlook because that would undermine opportunities for the creation and generation of new knowledge, and that such researchers must seek to respect all forms and sources of knowledge. This is because each methodology, however seemingly different, can add value and enhance the process of creation of new knowledge as each brings insights and tools on how to perceive and interpret the world.

The debate highlights the fact that indigenous physics exists in its own right; it does not need to explain itself to anyone such as the western knowledge system advocates. It therefore needs no justification outside itself. Furthermore, indigenous physics presents a valid understanding of nature in its own right. It does not employ experiment in the scientific Western sense. Indigenous physics deals with connections, harmony and relationships rather than with mechanical influences. People were and are able to make use of certain processes in order to bring desired results. The stress is laid upon direct objective experience and upon closeness to nature. The application of physics principles in the development of indigenous technologies will help in the production of more valuable goods that conform to modern standards and can be marketed beyond indigenous communities (Abiodun, 1998). In addition, Gallenstein (2003) emphasizes that the physical environment teachers create for learning has implications for learners' involvement and interaction. Therefore, for learners to effectively acquire physics concepts, the learning environment should have the following features:

- provide resources that encourage active learning, involvement, negotiation and collaboration;
- consider learners' cognitive abilities, emerging social skills and provide sufficient resources to alleviate disputes while at the same time assisting learners to negotiate with their peers;
- provide opportunities for children to make choices and make sufficient resources in a way that they are accessible to children. This procedure empowers children to be in control of their own learning and become deeply engaged in experiences of interest;
- provide ongoing experiences using learning projects to facilitate in-depth investigations and promote collaborative learning; and
- expose children to science experiences that provide appropriate levels of challenge and adult guidance to promote success and build feelings of competence (Gallenstein, 2003).

The physics educators need to be resourceful and be ready to answer a wide range of questions that arise from physics learners. The teacher should have the following aims in mind, which assume learner experience of indigenous knowledge:

- To arouse learners curiosity and interest in the world around them.
- To help learners develop their observations and discovery skills.
- To help learners develop the required science language that enables them to further and record their observations, clarify their findings and to describe their discoveries accurately.
- To help learners develop appreciation for use of science in their daily life.

The importance of IKS, including indigenous knowledge of physics, is supported by the United Nations (2007) article 14 (1) which argues that indigenous people have the right to establish and control their education systems and institutions in a manner appropriate to their cultural methods of teaching and learning. Chisholm (2005) cites critics such as Muller (2001) as saying education that focuses on the local, known and everyday life is not education, for at the heart of the instructive effort is a leading away from the known, familiar and everyday into universal processes. The debate indicates that Westerners, however, ended up imposing their indigenous knowledge on the local people and thus displaced the local people's existing knowledge (Hewson & Ogunniyi, 2011). It can, therefore, be argued that indigenous knowledge existed in western and non-western worlds, and that indigenous knowledge still exists among different ethnic groups in African communities and other societies.

In a nutshell, Khupe (2014) argues that if indigenous knowledge and physics are to be inclusive, then all indigenous knowledge, Western and non-Western, should be considered, otherwise it defeats the essence of inclusion. The debate on indigenous knowledge recognizes the importance of the cultural context in advancing and engaging students' learning experiences. Cultural context is the foundation for engaging indigenous knowledge as a way to make learning relevant and avoid cultural dissonance between what is learnt in school and everyday life (Khupe, 2014). Such is the argument that indigenous physics has a significant role in the conventional physics laboratory.

CONCLUSION

In conclusion, indigenous physics may be perceived as a way of knowing and a way of life. This chapter highlighted the fact that physics teachers and lecturers can draw on indigenous African knowledge as they teach science. The chapter interrogated the concept of indigenous physics as knowledge that exists in society to promote development and that curriculum development planners and academics should take into account the accumulated knowledge and traditional skills that are relevant to the lived experiences of students in African schools. This is because indigenous physics knowledge, whether institutionalized or not, structured or unstructured, has specific implications for democratization, community empowerment and

nation- building. Equally significant is the western notions and assumptions that indigenous physics knowledge should be trivialized and neglected by western education in Africa. Instead, it should be preserved, transferred and adopted, since any form of knowledge makes meaning only within its own cultural situation. Indeed there should be shared meanings that are key factors in binding people and societies as vehicles of social cohabitation (Mapara, 2009). The application of physics principles in the development of indigenous physics-related technologies will help in the production of more valuable goods that conform to modern standards and can be marketed beyond traditional communities.

REFERENCES

Abiodun, J. O. (1998). *Indigenous knowledge and sustainable development in Nigeria*. Ibadan: University of Ibadan Press.

Chisholm, L. (2005). The making of South Africa's revised national curriculum statement. *Journal of Curriculum Studies, 37*(2), 193–203.

Clark, L. H. (1997). Science and technology in Akwa Ibom State: Visions and perspective experience. *The Science Teacher*, *49*(4), 24–25.

Clements, D. H. (2001). Mathematics in pre-school. *Teaching Children Mathematics*, *7*(5), 270–275.

Emeagwali, G. (2003). African indigenous knowledge systems: Implications for the curriculum. In T. Falola (Ed.), *Ghana in Africa and the world: Essays in honour of Adu Boahen*. New Jersey, NJ: Africa World Press.

Gallenstein, N. I. (2003). *Creative construction of mathematics and science concepts in early childhood*. Olney, MD: Association for Childhood Education International.

Ginsburg, H. P., & Golbeck, S. L. (2004). Thoughts on the future of research on mathematics and science learning and education. *Early Childhood Research Quarterly, 19*(1), 190–200.

Hewson, M. G., & Ogunniyi, M. B. (2011). Argumentation-teaching as a method to introduce indigenous knowledge into science classrooms: Opportunities and challenges. *Cultural Studies of Science Education, 6*(3), 679 –692.

Horsthemke, K. (2008). The idea of indigenous knowledge. *Archaeologies Journal of the world Archaeological Congress, 4*(1), 130–141.

Khupe, C. (2014). *Indigenous knowledge and school science: Possibilities for integration.* Johannesburg: University of Witwatersrand.

LaBudde, E. V. (1999). *A design procedure for maximizing altitude performance*. A research and development project submitted at NARAM (NAR #73451), Westlake Village, CA.

Laccarino, M. (2003). Western science could learn a thing or two from the way science is done in other cultures. *EMBO Reports*, *4*(3), 220–223.

Mapara, J. (2009). Indigenous knowledge systems in Zimbabwe: Juxtaposing post-colonial theory. *Journal of Pan African Studies*, *3*(1), 139–156.

Mawere, M. (2014). *Culture, indigenous knowledge and development in Africa: Reviving interconnections for sustainable development.* Cameroon: Langaa RPCIG.

McGrath, C. (2010). *Supporting early mathematical development. Practical approaches to play-based learning*. New York, NY: Routledge.

Miyazaki, T., Mukaiyama, K., Komori, Y., Okagawa, K., Taguchi, S., & Sugiura, H. (2013). Aerodynamic properties of an archery arrow. *Sports Engineering*, *16*, 43–45.

Mji, G. (2009). *In doing disability research: A practical guide to disability research in Africa.* Cape Town, South Africa: The Secretariat of the African Decade for Persons with Disabilities.

Mkabela, Q. (2005). Using the Afrocentric method in researching indigenous African culture. *The Qualitative Report*, *10*(1), 178–189.

Mulligan, S. A. (2003). Assistive technology: Supporting the participation of children with disabilities. *Young Children*, *58*(6), 50–51.

Newman, J. (2008). *Physics of the life sciences*. New York, NY: Springer Science.
Ngara, C. (2007). African ways of knowing and pedagogy revisited. *Journal of International Education. Special Issue on Indigenous Ways of Knowing, 2*(2), 7–20.
Nsamenang, A. B. (2006). Human ontogenesis: An indigenous African view on development and intelligence. *International Journal of Psychology*, *41*(4), 293–297.
Nyota, S., & Mapara, J. (2008). Shona traditional children's games and play: Songs as indigenous ways of knowing. *Journal of Pan African Studies*, *2*(4), 189–202.
Pence, A., & Nsamenang, B. (2008). *A case for early childhood development in sub-Saharan Africa* (Working Paper No. 51). The Hague, The Netherlands: Bernard van Leer Foundation.
Sabinet. (2015). *Indigenous knowledge systems and academic institutions in South Africa*. Retrieved March 4, 2015, from http://reference.sabinet.co.za/sa_epublication_article/persed
Salomon, G., & Mendeleev, D. (2009). *Fundamentals of sliding friction*. New York, NY: Francis & Taylor.
Shizha, E. (2006). Legitimizing indigenous knowledge in Zimbabwe: A theoretical analysis of post-colonial school knowledge and its colonial legacy. *Journal of Contemporary Issues in Education*, *1*(1), 20–35.
Shizha, E. (2007). Critical analysis of problems encountered in incorporating indigenous knowledge in science teaching by primary school teachers in Zimbabwe. *Alberta Journal of Educational Research, 53*(3), 302–319.
Shizha, E. (2008). Indigenous? What indigenous knowledge in Zimbabwe? Beliefs and attitudes of rural primary school teachers towards indigenous knowledge in the school curricula in Zimbabwe. *The Australian Journal of Indigenous Education*, *37*, 80–90.
Shizha, E. (2013). Reclaiming our voices: The African school curriculum problem with post-colonial Sub-Saharan Africa. *Journal of Indigenous Social Development, 2*(1), 1–18.
Shizha, E. (2014). Rethinking contemporary Sub-Saharan African school knowledge: Restoring the indigenous African cultures. *International Journal for Cross-Disciplinary Subjects in Education (IJCDSE), Special Issue*, *4*(1), 1870–1878.
Stavy, R., & Tirosh, D. (2000). *How students misunderstand science and mathematics: Intuitive rules*. New York, NY: Teachers' College Press.
Tanyanyiwa, V. I., & Chikwanha, M. (2011). The role of indigenous knowledge systems in the management of forest resources in Mugabe area, Masvingo, Zimbabwe. *Journal of Sustainable Development in Africa*, *13*(3), 132–149.
Tippens, P. E. (2007). *Uniform circular motion*. A Powerpoint presentation at the Southern Polytechnic State University, Marietta, GA.
United Nations. (2007). *The UN declaration on the rights of indigenous peoples*. New York, NY: United Nations.
Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes.* Cambridge: Harvard University Press.
Worldwide Indigenous Science Network. (2013). *What is indigenous science*? Retrieved May 23, 2015, from www.wisn.org/what-is-indigenous-science.html
Young, K., Longboat, D. R., & Kulnieks, A. (2013). *Contemporary studies in environmental and indigenous pedagogies: A curricula of stories and place*. Rotterdam, The Netherlands: Sense Publishers.

ATAH PINE

8. TIV DIVINATION

INTRODUCTION

Divination is an ancient indigenous knowledge system (Hountondji, 1997; Akinwumi et al., 2007). Its cultural-institutional provenance cannot be stated with historical exactitude. It arose, philosophically and anthropologically speaking, as a result of the quest to understand, interpret and give meaningful expressions to both natural and supernatural phenomenon. Since the dawn of humanity, the human mind has always been inquisitive and interested in questions such as: Who created humanity? What controls destiny? Where do we go after death? Are there rules guiding life? Divination, therefore, evolved as a proto-scientific and metaphisico-epistemological intellectual enterprise to assist humanity in the interrogation of existential reality.

Among the varieties of instrumentalities deployed across different societies in divination are: a) heavenly bodies, such as stars, planets, constellations, eclipses, comets, b) terrestrial omens such as animal migrations, weather patterns, bones, amulets, rocks, and forms of tossed sticks; c) inner spaces, such as dreams, d) hallucinogenic plants, e) sacred set of dice. *One* major means of the intergenerational transfer of divinatory knowledge is oral traditions. Conceptualizing divination has been a site of intense contestations (Herbert, 1991; Mbiti, 1975; Adelewo, 1987; Ekechukwu, 1982; Muthengi, 1993). Essentially, divination is a form of communication between natural and supernatural agencies. In the words of Oppenheim (1977, p. 207) 'basically, divination represents a technique of communication with the supernatural forces that are supposed to shape the history of the individual as well as that of the group. It presupposes the belief that these powers are able and, at times, willing to communicate their intentions and that they are interested in the well-being of the individual or the group; in other words, that if evil is predicted or threatened, it can be averted through appropriate means.'

In spite of the drubbings of colonialism, cultural genocide, and the pressures of modernization, divination and its allurements have continued to exert radical influences on contemporary African society. This triumph of divination in contemporary society has negated the view that modernists' values would erode traditional values. This fact is also true of Tiv divination, known as, *Ishor-ikpehen.* This chapter, therefore, examines the practice of Tiv divination, especially, in terms of its construction of the notions of space, power and knowledge.

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TIV DIVINATION: SOME NOTES

Divination is very central in the cosmological thought of Africans. This is so because African cosmology is not binary in structure, that is, matter and spirit, but is unitarist, eliding the natural/visible and the supernatural/invisible boundaries (Anyanwu, 1976). The African worldview is often indissolubly tied to culture and religion. The supernatural and natural cohabit in the production of meaning and interpretations of phenomenon. It is partly on account of this that illness in Africa is attributable to spiritual dislocations, among other factors (Schulles & Hoffmann, 1992). Commenting on this, Anyanwu (1976, p. 121) contends that:

> In African communities, the diviners have the duty of interpreting and enunciating the relationship between the African people and the invisible forces. The ancestors and deities influence the behavior and activities of the people. The deities can be employed by individuals and the whole community to accomplish their goals. It could be said that a form of social-spiritual-material contract exists between the African people and the deities in as much as they are "worshipped" or "revered" only if they offered the people their wishes.

The Tiv worldview is also premised on this incestuous relationship between the natural and supernatural worlds. Consequently, Tiv people seek solutions to their problems both in the natural and supernatural domains. In their worldview, the power of life and death of a person is in the hands of either his/her paternal or material kinsmen. As such, the Tiv people make much use of divination in establishing their physical and spiritual wellbeing. Like in other societies, the reasons for divination in Tiv society are varied. This could be due to: a) illness, b) fear of witches or other malevolent spiritual forces, c) barrenness, d) fear of imminent death, e) poverty, f) lack of wife and children, g) fortification of oneself against spiritual attacks, etc.

Tiv divination is very complex and dynamic in its organization and structure. It embraces all the elements of their worldview (Akiga, 1939; Bohannan, 1975; Shishima, 2007). The diviner in Tiv is known as *or-ishor*. The divination process is called *Ishor ikpehen.* The diviner plays very significant roles in Tiv society. According to Shishima (2007, p. 407):

> Among the Tiv, a diviner is the father and revealer of secrets who by virtue of his/her extra-curricular sensitivity to spiritual reality and training uncover the mysteries of human life by revealing the past, present and even future secrets of hidden things and facts. He/she also belongs to the category of medicine men both in training and duties. He/she seeks to interpret and explain the mysteries of life, convey the message of God, divinities and the ancestors and other spirits to the members of the community. Gives guidance in daily affairs, settles disputes, diagnoses diseases, gives solutions to various problems and looks into the future. Is consulted freely by the people for both public and

> private affairs who look upon him/her as counselor, pastor, fortuneteller, soothsayer, prophet, priest, seer and solver of all problems? In fact, the diviner is seen as a mirror in Tiv society (sic).

Becoming a diviner in Tiv society can be either through inheritance, apprenticeship or divine call. In the latter case, usually a disease afflicts a potential diviner and the spirits miraculously heal such a person and he or she, thereafter, is commissioned by the spirits to go forth and become a diviner and help humanity. The most important element in becoming a diviner in Tiv society is the ability to transmit and receive supernatural communications. Professional training is a very important element of Tiv divination. The curriculum of such training involves mediumistic communication, botanical knowledge, Tiv medicine, Tiv culture, veneration of spirits and ancestral agencies, and other acts ancillary to the secrets of divination. Different paraphernalia and materials such as water, mirrors, regalia; cowrie shells, snail shells, tortoise shells, bird feathers, etc, are used in Tiv divination.

Generally, a potpourri of socio-historical, cultural, epistemological, and religious factors influence and shape every divination system. And as such, divination need not be essentially seen in religio-spiritual terms. Taking this into consideration, this work looks at Tiv divination in spatial terms. Space is a critical element in the understanding of human social organization (Gans, 2002). As noted by Lawuyi (2003, p. 3), "spatial consciousness has implications for the way society is organized, its environment managed, and its socio-cultural development pursued. Space organizes and structures human relations in ways specific to its peculiar feature."

SACRED SPACE AND THE DIVINE CONTRACT

Tiv divination usually takes place with all consulters present taking their turns to see the diviner. The divination space is at once a cultural and public space. It is undergirded by cultural values, norms, mores and practices that are peculiar to a community. A social space is characterized by certain attributes (Barker, 2005, pp. 349–350). Some of these are: (i) spaces are socially constructed; (ii) social space is not static but dynamic, it is constituted by changing social relations; (iv) space is implicated in questions of power and symbolism; (v) social space implies a simultaneous multiplicity of spaces: cross-cutting, intersecting, aligning with one another, or existing in relations of paradox or antagonism

The Tiv divination domain is conceptualized as a sacred space and as such it is held in solemn and worshipful esteem. Before a house is designated for divination, there are purificatory and ritual rites that are carried out. The essence of these rites is to cleanse the area of all malevolent impurities that could constrain the diviner's supernatural communication, fortification against desacralization and dedication of the domain as the abode of the spirits. The sacral content of the divination locality extends far beyond its spatial precincts. Outside the house, usually behind it, a shrine known as *dwer ishor* is erected. It is in this shrine that the spiritual forces that

superintends over a divination reside. Both inside and outside the divination area—that is, the entire compound—sacrifices involving the slaughtering of animals and chickens are carried out and, in the end, charms and other spiritual concoctions are buried underneath the divination space. What constitutes the ingredients of these charms and concoctions vary from place to place—diviner to diviner.

The Tiv divination space is adorned with such material items such as calabashes, zoomorphic artifacts/ensembles, water, smoking pipe, pots, cowrie shells, mirror, sculpted images, murals, and lots of fresh and dried herbs, among others. Unlike in western medicine where the doctor examines patients privately, in Tiv divination, consultation is open and public. All consulters sit in the same space and take turns to consult the diviner. Indeed, in some cases diviners often ask a consulter a question and request that other consulters can assist with the answer. All this is done to enhance the divination process.

POWER AND KNOWLEDGE IN TIV DIVINATION

The Tiv believe that the knowledge of the diviner comes from the supernatural realm. The process of obtaining knowledge of divination is twofold (i) the administering of *Ichir ki ishor*, divination medicine, on a divination apprentice (ii) *mbatarlegh yilam* (divine call). Divination medicine is prepared using different types of herbs, mixed with alligator pepper (*Ikyehegh*), *agabi nono* (cow milk), *mgbakpa/hoodzwa u Tiv* (Tiv pepper). Once this medicine is taken, the mind would open up (bugh ishima). The Tiv believe that divination takes place in the mind. In the case of *mbatarlegh yilam,* divination comes through divine intervention. These types of diviners are mostly called through sickness. In our fieldwork, most of the diviners that were divinely called were women.

Divine call usually comes this way: someone takes ill and all prescribed medications prove abortive. Then one day, in a trance or dream, spirits would reveal the right medication and the person would be healed. In our fieldwork, most of the diviners that fall into this category were women who suffered from *akombo a iyol genen* (body convulsion). Interviewees included Baby Tyoshioor, Mama Alu and Fachi Shirsha. In her account of how she become a diviner, Fachi Shirsha, states that:

> One day I went to the stream to fetch water, while in the stream I heard a voice calling on me. The voice said that I should become a diviner. However, I disobeyed the voice because I wanted to have western education. When I refused to heed this call, I took ill and was beaten by unseen persons. I had no option than to accede to the demand of the spirits. Once I accepted to become a diviner, my health was restored. Divination by divine call runs in our family.

The Tiv believe that knowledge of divination comes from the spirits and it is transmitted to the diviner through the mind. It is for this reason that there is this divination saying, *ka akpehen we ishor u kpehen a ishima you*. Much as they believe

in the spirits, they also believe in the possibility of human agency. To check this issue, both the diviner and consulter wield enormous powers in Tiv divination.

It is the combination of power relations that give Tiv divination its unique institutional identity. It is important to state here that our notion of power draws its conceptual inspiration from Foucaultian archaeological analysis. It is used in a sociological/social rather than juridical/political sense. As posited by Foucault (1978, p. 93):

> Power is everywhere; not because it embraces everything but because it comes from everywhere. And "power", insofar as it is permanent, repetitious, inert, and self-reproducing, is simply the overall effect that emerges from all these mobilities, the concatenation that rests on each of them and seeks in turn to arrest their movement… Power is not an institution, and not a structure; neither is it a certain strength we are endowed with, it is the name that one attributes to a complex strategic situation in a particular society.

Knowledge linked to power not only assumes the authority of 'the truth' but has the power to make it true. All knowledge once applied in the real world has effects, and in that sense at least becomes true. Power, therefore, to Foucault, is essentially and simply the ability to create change in society or in the behaviour of individuals, be it positive or negative. Power is then everywhere, in every relationship; we are constantly subjecting it and being objects of it.

Wielding power does not necessarily connote and denote authoritarian, tyrannical and domineering usage. Rather, power is exercised with considerations of ethics, what he terms 'practice of the self', in order to avoid its abuse. "Power is everywhere; it is diffused, and embodied in discourse, knowledge and regimes of truth." Power to Foucault is simply what makes us, what we are. "Power is everywhere" and "comes from everywhere" (Foucault, 1978, p. 93). Knowledge is power and power is embedded in social practices. Divination is a form of social practice; therefore, power is embedded in its practice. Power deployed in any form and context has tremendous impact on both the wielder and recipient/object of power alike (William, 2003). Adopting this conceptual framework, one question arises: What is the nature of power relations in Tiv divination?

First, we begin with the consulters. Meaning is highly contested in Tiv divination. When a diviner makes a proclamation, it is not considered *ex cathedra,* a pronouncement of oracular infallibility. It is for this reason that the Tiv practice multiple divination consultation. The multiple divination practice allows a consulter to visit three to four diviners on any particular issue. Such diviners are usually very far off from the consulters' locality. The reason is to avoid situations where a diviner's revelations would be influenced by local issues and gossips. After visiting these diviners, the consulter would compare and contrast information at his/her disposal, and on the basis of that, draw conclusions.

Secondly, there is the test of the authenticity of a diviner's supernatural knowledge. In contemporary times, especially due to the corrosive influence of crass

commercialism, Tiv consulters are usually skeptical of diviners for the fear that they may not be truly called. As a result, consulters usually want to know if a diviner's knowledge is really from the supernatural realm. Consequently, they have devised ways of testing diviners. One way of doing this is by giving false information to the diviner. For instance, a consulter would tell a diviner that their relative got sick, whereas nothing of the sort had happened. The question of trust emerges in such circumstances. Should the diviner make pronouncement on such false information, the consulter would confirm that such a diviner was fake. On the other hand, if the diviner told the consulter that nothing of the sort had happened, such a diviner was said to be truly gifted.

An interview with Ageva Yakpa revealed that:

> One way to test the authentic knowledge of a diviner is to tell a lie and pretend that is your problem. If the diviner tells you anything about the lie you know he is fake. However, if the diviner tells you that is not what brought you to his/her divination hut, you then establish that he/she is a real diviner and on the basis of that you go ahead and consult.

This is not a too common practice in Tiv divination, but it is gaining ground. However, in order to avoid falling prey to this trap, some diviners tell consulters not to tell them the reason for their visit. Once you come before them, they reach out to the metaphysical realm and reel out what actually brought you to them. The revelation would then form the basis of the divination conversation. If the consulter questions the accuracy of the diviner's revelations, such a consulter is at liberty to leave.

Thirdly, there is the taking back of divination fee. Before the commencement of divination, a consulter usually pays a divination fee, known as *yar Ishor*. Such a fee is not supposed to be costly, because in the Tiv spiritual-medicinal imagination, costly fees are seen as being capable of eroding the medicinal potency. The practice is that if a consulter is not satisfied with the revelations of a diviner, such a consulter is at liberty to take back his/her divination fee. The philosophy that inspires this practice is underscored by the divinatory aphorism that *ka akpe hen we ishor u kpehen a ishima yoo*. Literally translated this means that if the diviner is consulting for you, you also consult in your mind.

The meaning of this aphorism is derived from the Tiv divination practice whereby consulters come to diviners with a preconceived notion on the likely cause(s) of their problems. The essence of the divination in reality is for the diviner to confirm to the consulter, the veracity of one or the other of his/her preconceptions, that is, the source of the problem. The practice is such that both the consulter and diviner are simultaneously involved in the divination: a principle of simultaneity. So if the diviner's revelations are in tandem with the consulter's circumstances, the latter would affirm with the saying *ka akpe hen we ishor u kpehen a ishima you*. However, if the diviner's revelations are to the contrary, the consulter would disagree. When

this happens, the consulter is at liberty to take back his/her divination fee. This is a very common practice in Tiv divination.

Fourthly, gestures. Gestures are veritable platforms of power formation in Tiv divination. If a consulter is not satisfied with the outcome of a divination, there are a variety of gestures that he/she indulges in to demonstrate his/her displeasure. These gestures among others are: intermittent hissing, unwillingness to respond to questions by the diviner, and where attempted rude answers. In situations where there is the disapproval of a diviner's revelations, consulters get easily upset. Consulter avoids facial contacts with the diviner, while frowning.

On the other side of the coin, the diviner also demonstrates power in a plethora of ways. One, before entering into the divination space, the consulter is required to take off his or her foot gear. The assumption is that the divination place is holy ground and as such the consulter must show reverence and respect. In an interview with a diviner, Faga Usue, the diviner revealed the reason consulters were asked to remove their foot gear:

> The spirits superintend over the affairs of humanity and as such are supreme. They deserve our respect. More importantly, as our masters, they deserve to be treated with dignity. Failure to do this will incur their wrath.

The knowledge of incantation is seen as a gift from the gods. As such, a diviner with the verbal fluency of incantation, is seen as being well-endowed by the deities. Such a diviner is seen as an old-timer, a core professional, and an accomplished diviner whose mastery of the divination process is unassailable. Incantations are drawn from the firmament of the Tiv cultural imagination. Incantations usually precede the divination proper and are accompanied with the manipulation of divination instruments and dramatizations. They are meant to venerate, to appeal and to appease the deities. Therefore, the more poetically versatile, artistically dexterous and gifted a diviner is in incantation, the more the respect he or she garners.

Artifacts and Decorations in the Divination Arena

The Tiv divination house, indeed, the compound of a diviner is littered with assorted artifacts and decorations. These artifacts and decorations are made up of items such as animal horns, animal skins especially of lions, leopards, monkey, pieces of cloths—normally red, black and white—hoisted as flags and/or wrapped around tree trunks, local pots, egg shells, cowries, feathers, and so on. The truth is that all these artifacts have nothing to do with divinatory potency. Actually, there are two types of *Ishor* (divination) in Tiv: (i) *leke gabi* and (ii) *bija*. In the *leke gabi* mode of divination, divination can take place anywhere without the requisite divination instruments or paraphernalia. In the *bija* case*,* divination cannot take place outside the arena specially designed for that purpose, that is, a divination house (Apaa Bar). The point is that in Tiv divination, artifacts are the hood and not the monk. Without

these artifacts, a diviner can still consult. However, they are meant to implant in the mind of consulters fear, reverence and respect for the diviner's powers. If a diviner's compound is not so adorned, there is the tendency for consulters not to consider such a diviner. Horror and fear-inducing aestheticization of the divination compound is critical in the Tiv metaphysical imagination.

TIV DIVINATION AND MEDICINE

Divination is a critical component of the African health-care delivery system (Ajala, 2013). This is so because African medicinal thought is philosophically premised on the elision of the natural and supernatural domains in the interrogation of phenomenon. On account of this fact, disease conditions are interpreted as having either natural or supernatural etiological provenances. Commonplace biological infractions, such as headaches, stomachache, cough and the like are ascribed to natural indispositions. However, when such infractions take on a regular and health-threatening dimension, it is said to be supernatural.

The philosophical foundations of African health are premised on wholistic treatment of illness. To be healthy transcends mere wellness and functionality of the body system. It entails the harmonious relationship between the natural and supernatural (Ikenga-Metuh, 1987, 1991). This also applies to the Tiv and their understanding of human health. Health is not purely understood in biological terms. It is embroidered in the tapestry of sociological, ontological, psychological, physiology and spiritual intertwining. In the Tiv etiological imagination, disease is a consequential act arising from irruptions in one's cosmic balance. Tiv medical practice is therefore spiritual and religiously oriented. It relies on herbal mixtures and concoctions garnished with zoomorphic elements. It is believed that such herbs and mixtures are animated by supernatural forces. It is for this reason that diviners are also good medical practitioners. For they combine both their supernatural gifts and herbal knowledge to make effective pathological/clinical analysis.

Most often, herbal knowledge is attributed to instructions from the deities. It is because of these spiritual dimensions that medical practitioners usually recite incantations, invocations, sacrifices and make supplications to the deities to imbue the herbs they use with medicinal potency. Thus, diviners play central roles in Tiv health system because relating with the supernatural is their specialty. In Tiv medical practice, divination is used in the diagnosis of disease (*angev*). Disease generally is the state of biological disequilibrium of the human body. Such disequilibrium can be caused either naturally or supernaturally. Supernatural diseases are caused through a plethora of ways. For instance, it could be due to one's violation of cultural prohibitions and taboos (*mtswer*), contravention of ritual laws (*akombo*), annoyance of the spirits (*mbatarlegh*), offending of the sensibilities of kinsmen (matrilineal and/or patrilineal), non-payment of bride-wealth, the improper distribution of bride-wealth; spiritual attack by one's enemies due to jealousy (*iyuhe*) or envy (*ishimanyian*).

Diseases that are often taken to diviners for diagnostic analysis are psychiatric disorders (*ihundugh*), barrenness, arthritis (*akpiti*), swollen stomach (*iyav mbu morun*), bad dreams, omens, etc. In recent times, there have been diseases on the rise in Tiv land, such as: spiritual fire (*usu*) or spiritual HIV/AIDS (ta *anakande*). Generally, in Africa, the causes of diseases could come from a variety of sources such as lack of respect for elders, adultery with a neighbour's wife, incest, quarrels, jealousy and culturally unacceptable marriages (Ikenga-Metuh & Ojoade, 1990, p. 236). To be a good divination practitioner in Tiv society, therefore, one must possess good knowledge of Tiv culture, traditions, and medicine. In fact, in contemporary Tiv divination practice, most diviners also double as medical practitioners. The practice is such that diviners have built solid professional specializations and networks. For instance, if a diviner diagnosed an ailment that is not in his/her area of professional competence, he/she gives referral to another diviner that specializes in this area.

Generally, divination is highly valued among the Tiv both for its religio-spiritual and medical importance. It has proven since time immemorial to be very effective and efficient in healing and spiritual cleansing; hence its continued relevance and use in Tiv land. Indeed, there are many diseases that defy orthodox western medical treatment but are cured using the medical knowledge of Tiv diviners. It is therefore recommended that the system should be encouraged and incorporated as an integral part of the modern health-care architecture.

CONCLUSION

The divinatory practice of any human community is an embodiment of its worldview. The Tiv case has amply demonstrated how divination embodies their physical, metaphysical, cultural, epistemological and spiritual thoughts. The critical lessons to be learnt from the sociology of Tiv divination are threefold: One, that the relationship that existed between Africans and supernatural beings is not one of fatalistic sheepishness as racist traducers are wont to assert. On the contrary, such relations are premised on rational and critical engagements. Two, indigenous knowledge systems are characterized by power dynamics and institutional checks and balances that promote the organic integrity and solidity of society. Three, cultural institutions and practices are the epistemic foundation for generating knowledge to address societal challenges. It is, therefore, recommended that indigenous knowledge systems be mainstreamed in contemporary development efforts.

REFERENCES

Adelewo, E. D. (1987). Divination as an aspect of healing processes in the major religions of Nigeria. *African Theological Journal*, *16*(1), 70–95.

Ageva, Yakpa, 74, Interview at Mbashior, Benue State date 21/11/2015.

Ajala, A. S. (2013). Ifa divination: A diagnostic and therapeutic device in Yoruba healing system. In W. E. A. Van Beek & P. M. Peek (Eds.), *Reviewing reality: Dynamics of African divination* (pp. 115–138). Zurich: LIT VERLAG GmbH & Co. KG Wien.

Anyanwu, K. C. (1976). Alien religions influence on African religion and social change. *Ufahamu: A Journal of African Studies*, *6*(3), 119–134.
Apaa Bar, 68, Interview at Tsebo, Benue State; 21/11/2015.
Baby Tyoshioor, 47, Diviner, Interview at Ikpayongo, Benue State; 15/11/2015.
Barker, C. (2005). *Cultural studies: Theory and practice.* London: Sage Publications.
Bohannan, P. (1975). Tiv divination. In J. H. M. Beattie & Leichardt (Eds.), *Studies in social anthropology.* Oxford: Clarendon Press.
Ekechukwu, A. (1982). Suffering in Igbo tradition. *AFER, 24*.
Fachir Shirsha, 62, Diviner, Interview at Ikpayongo, Benue State; 15/11/2015
Faga Usue, 55, Interview at Makurdi, Benue State; 14/11/2015.
Foucault, M. (1978). *The history of sexuality: An introduction.* New York, NY: Vintage Books.
Gans, H. J. (2002). *The sociology of space: A use-centered view.* Washington, DC: American Sociological Association.
Greenfield, J. C., & Sokoloff, M. (1989). Astrological and related omen texts in Jewish Palestinian Aramaic. *Journal of Near Eastern Studies, 48*(3), 201–214.
Ikenga-Metuh, E. (1987). *Comparative studies of African traditional religions*. Onitsha: IMICO Publishers.
Ikenga-Metuh, E. (1991). *African religions in Western conceptual schemes: The problem of interpretation: Studies in Igbo religion.* Onitsha: IMICO Publishers
Ikenga-Metuh, E., & Ojoade, O. (Eds.). (1990). *Nigerian cultural heritage.* Onitsha: IMICO Publishers.
Lawuyi, O. B. (2003). Chaos in the public space: Environment, morality and popular culture in Nigeria. *Ibadan Journal of Humanistic Studies*, (No. 13 & 14).
Mama Alu 70, Diviner, Interview at Ikpayongo, Benue State; 09/12/2015.
Mbiti, J. S. (1975). *Introduction to African religion*. New York, NY: Praeger Publisher.
Muthengi, J. K. (1993). The art of divination in African. *Journal of Evangelical Theology, 12*(2), 90–104.
Oppenheim, L. (1977). *Ancient Mesopotamia: Portrait of a dead civilization*. Chicago, IL: The University of Chicago Press.
Radin, P. (1927). *Primitive man as Philosopher.* New York, NY: D. Appleton Company.
Shishima, D. S. (2007). Divination in Tiv belief system. In O. Akinwunmi, O. Okpeh, C. B. N. Ogbogbo, & A. Onoja (Eds.), *African indigenous science and knowledge system: Triumphs and tribulations essays in honour of Professor Gloria Thomas Emeagwali.* Abuja: Root Books & Journals Ltd.

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9. THE STELLAR KNOWLEDGE OF INDIGENOUS SOUTH AFRICANS

Little or no distinction is made between stars and planets in this chapter, except where indicated, in keeping with many traditional celestial beliefs. Use is instead made of the generic term: *stars*. Constellations are essentially a northern hemispheric notion and were not a feature of the South Africa of yesteryear. It should be remembered, too, that northern hemisphere constellations appear upside down in the southern hemisphere due to perspective. There are, of course, constellations specific to the southern hemisphere, and which are not inverted. Certain so-called 'constellations' or associations of stars were indeed known to the indigenous inhabitants of southern Africa. We shall focus on Zulu, Swazi and Xhosa perceptions and propositions of the stellar world.

THE ZULU

Jupiter: iNdonsa; iNdonsakusa or iNdonsamasuku

The planet *iNdonsa* is so named because of its slow movement, as though straining. The explanation given by Doke and Vilakazi (1948) is that the verb *donsa* means to 'pull, draw, drag, tug, strain'. The word *iNdonsalmsa* means 'what draws the dawn', while *iNdonsamasuku* means 'what draws on the days'. A further name for this planet, as per Doke and Vilakazi, is *iNqonqoyi.* Jupiter is the largest planet in the Solar System, and excluding the Sun, is second only to the Moon and Venus in terms of apparent magnitude (brightness). It is a fact that Jupiter, as seen from distant Earth, has an apparent slowness of motion when viewed against the stars (Mack, 1996; Mayall & Mayall, 1954; Jones, 2007). The Zulu reference to 'what draws the dawn' and 'what draws on the days' suggests that the appearance of the planet in the early morning was the prevailing perception or Jupiter (i.e., that this planet was then significant by announcing the arrival of another day to the Zulu).

Mars: iNdonsa

This name (see Jupiter) is also applicable to Mars 'as it rises in the evening' (Doke & Vilakazi, 1948). Callaway (1870) refers to*/ndosa* (his spelling) as a star which rises before the Morning Star, *i.e*., when the night is already advanced. If men remain awake drinking beer or eating meat at a wedding feast and see that *Indosa*

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has risen ('arises red'), they know it is time to sleep since it is night. Callaway (1870) states further that in the morning *Indosa* is very high in the heavens, and that the Morning Star has risen. The key here would seem to be the red colour of the star which strongly suggests that Mars and not Jupiter is being described. Mars is sometimes visible in the early morning twilight, and subsequently for various periods during the night. This planet disappears from sight every other year and usually remains invisible for a number of months (longer than any other planet). The apparent magnitude of Mars changes considerably as a result of a rather variable distance between Mars and the Earth, and reaches a maxi mum at intervals of 15 or 17 years around August or September. The planet is then especially noticeable in southern Africa. Mars approaches to within 56×10^6 km of the Earth, which is closer than any other planet with the exception of Venus. (Venus, in turn, approaches to within 40×10^6 km of the Earth.) The apparent magnitude of Mars varies from very bright to rather faint. Mars is generally a fairly inconspicuous celestial body and is the faintest of all the naked-eye planets when at a maximum distance from Earth. The key identification mechanism for Mars is its colour. It is possible to confuse Mars with the red giants, Antares and Aldebaran, depending on the position of Mars and its brightness at the time of viewing (Mack, 1996; Rudaux & de Vaucouleurs, 1967; Fairall, 2006; Mayall & Mayall, 1954; Jones, 2007).

Orion's Belt: iMpambano

Orion's Belt consists of three prominent stars. These are Mintaka, Alnilam (the central and brightest star) and Alnitak. The original source of the Zulu information is Samuelson (1929; 1974), repeated in Doke and Vilakazi (1948), and cited by Krige (1950). The celestial term used was the Orion's Belt constellation or the constellation of Orion's Belt. The correct term for Orion's Belt, however, is an asterism in the constellation of Orion. What is seemingly at fault here is Samuelson's understanding of a constellation as well as certain other astronomical topics. Koopman (2002) states that the Zulu name is derived from the verb *phambana,* which according to Doke and Vilakazi means to "lie across one another; cross one another; pass one another" in the manner of roads crossing one another, or people passing each other at night, but without seeing one another. Krige (1950) refers to a small string of stars faintly visible on the right of Orion's Belt, and known by the Zulu as *oNdwenjana* or *iNdwendweni.* The latter name was used in Natal. Koopman quoting Doke and Vilakazi (1948) gives the name, in the plural only, as *oNdwendweni* ('a small string of stars near Orion'); or *oNdwenjana,* in the plural only, which is the meaning first indicated in this paragraph. It should be noted that a string or line of three faint and fuzzy stars constitutes Orion's Sword (likewise an asterism), which is situated above the Belt in the southern hemisphere. The star seen at the base of the Sword is 42 Orionis, sometimes referred to simply as *c.* (Some older texts, however, state that sigma (cr) Orionis, a multiple star, constitutes the base or hilt of the Sword.) The star forming the centre of the Sword is theta (0) Orionis, which is a multiple (quadruple)

star. One of the best-known nebulae in the sky, M42 (NGC 1976), the Great Orion Nebula, is visible to the naked eye as a fuzzy patch and surrounds Orionis. The triple star at the tip or point of the Sword is iota (1) Orionis, also known as Hatsya or Na'ir al Saif, and is the brightest of the three stars in the Sword (Jones, 2007; FitzGerald, 2005; Staal, 1961). The Zulu stars in question must surely be those of Orion's Sword. Orion is high in the sky in summer, with the Belt always rising due east and setting due west (Turk, 2001). Orion starts to disappear from view around May and is visible once more in the east, in the late evening, about October.

The Milky Way: uMthala

The Milky Way is a very prominent feature of the night sky and is readily visible to the naked eye in a dark sky. The Milky Way is said to resemble the inside of a cow's stomach, hence the Zulu name (1. Msomi). Bryant (1905) gives several meanings for the word, one of which is a strip of fleshy muscle encircling the paunch of cattle. It is said that some Zulu were able to determine the time for daybreak from the orientation of the Milky Way in the sky (Lagercrantz, 1952). Rain, according to the Zulu, is coming when the Milky Way has a predominantly east-west orientation (*i.e*., in summer) (Msomi). No rain can be expected if the Milky Way is orientated in a north-south direction (in winter). One of the regiments (*umabutho*) established by Mpande, the Zulu king prior to Cetshwayo, was known as uNokenke (Faye, 1923). The name of the regiment or *ihutho* relates to those Zulu who were in a state of passive resistance to Mpande, *i.e*., whose loyalty was somewhat doubtful. The regimental name is indicative of people whose battle formation has extended beyond control, or a bull which has become bitter to its royal possessor (although having the exclusive royal color). The regiment was like the Milky Way: in sight, but quite out of reach or control. The source of the trouble concerned two sons of Mpande (Cetshwayo and Mbuyazi kaMpande), both of whom aspired to kingship. Mpande favored Mbuyazi, with many Zulu preferring Cetshwayo (Faye, l923). The regiment was founded in 1865 (Krige, 1950).

Venus

Venus is a very prominent feature of the night sky, and is the brightest object after the Sun and the Moon. Venus is so bright that it can cast a shadow when moonlight and artificial light are excluded. The planet can occasionally be seen in broad daylight with the naked eye. Venus, as previously discussed, is sometimes visible in the early evening in the west after sunset (the Evening Star), or in the morning before sunrise in the east (the Morni ng Star). Venus is then the first celestial object to appear in the evening or the last to disappear in the morning (excluding the Moon in both cases). Venus rises or sets no more than three hours and thirteen minutes before sunrise or after sunset. Venus cannot be seen for the full duration of this period due to the proximity of the planet to the Sun. Venus is thus only visible for a maximum of about

two hours a day in a dark sky. The planet can move rapidly from the evening sky into the morning sky (Mack, 1996; Rudaux & de Vaucouleurs, 1967; Jones, 2007).The Zulu did not recognize Venus as one and the same celestial body. The Evening Star (*iSicelankobe*) and the Morning Star (see below), according to the Zulu, were the two wives of the Moon (Mbiti, 1970). The Morning Star feeds the Moon well, and the Moon grows bigger. The Evening Star, in contrast, feeds the Moon badly, resulting in the Moon becoming thinner. Werner (1933), in discussing this very belief, refers to the 'Bantu in general' rather than the Zulu specifically. It is not known how many groups in southern Africa associated Venus (when visible during full daylight) with either the Morning Star or the Evening Star. A star known as *iNqonqoli* rises at about 03:00 and precedes the Morning Star (Krige, 1950). The season of observation was unfortunately not given. According to Buipin (1977), *iNqonqoli* was the first Morning Star whose name means to 'knock at the door' of night (*i.e*., to warn that the great change of dawn is coming). Venus or *iKhwezi* was the second Morning Star. The name *iKhwezi* means "the lifter up of the shadows and sleepers from the ground" (Buipin, 1977). The Zulu, in the early days, invariably attacked their enemies soon after the Morning Star had risen (Becker, 1972). Callaway (1870) described the Morning Star (*iKhwezi*) as keeping "its place constantly", and confirmed that the rising of the Morning Star indicated that morning was at hand. It was for this reason that both the sorcerer (*umthakathi*) and the spy (*inhloli*) rapidly turned back from their destinations in order to reach home before dawn.

A slightly different version provided by Samuelson (1974) is that *iNqonqoli,* the first Morning Star, rises at about 03:00 and is followed by *iKhMd* at approximately 04:00. The time of the year is again not stated. The word *iNqonqoli* is apparently a corruption of *iNqonqothi.* This word is derived from *Nqonqotha* or 'to knock at', as at a door knocked upon to be opened. The door knocked against (by *iNqonqoli*) was the door kept by *iKhwezi.* Visible a little later, thus lifting and removing the curtain of night and bringing in morning. The last-mentioned term (*iKhwezi*) is derived from the verb kweza which means "to lift up as a dress and keep it from dragging on the ground". Samuelson's family, while on a journey by foot or by ox-wagon, followed the Zulu custom and made fires to cook the morning meal or coffee when *iNqonqoli* rose. The oxen were released at that time to graze. When *iKhwezi* appeared, the Samuelson family packed up, inspanned the oxen and proceeded on their way (Samuelson, 1974). Another name for *iKhwezi* is *iNkangakusa* (Doke, Malcolm, & Sikakana, 1958). The latter name as per Koopman (2002) means 'attract the dawn'. Werner (1912) observed that the Zulu name of the Morning Star could be derived from the word *kweza* (the causative of *kwela*) meaning 'to ascend', that is, the one who 'brings up' the dawn. The inference here is that dawn is drawn up or pulled up from below the horizon by the Morning Star once this star has risen.

The preoccupation with Jupiter was perpetuated in a handbook written by Rudolph (1948) for Zulu-English translators in the courts. The times of day, amongst other things, are given in this book. The first events of the new day are as follows: first cockcrow; second cockcrow; the appearance of the Morning Star; third cockcrow;

the appearance of Jupiter; the descent of the fowls; very early morning; early dawn, and sunrise (Rudolph, 1948). The Morning Star is not named in the handbook, perhaps because detailed knowledge of the stars had died out by the late 1940s. lt is also possible that it had been realized by then that any association of this star with Uranus was nonsense. It will be recalled that Samuelson's book was first published in 1929. It is not definitely known what celestial indicators operated when the stars in question were not visible in the morning sky. Samuelson (1974) refers to *iSicelankobe* as "the drawer of days to their close," which is an apt description for the Evening Star. Doke and Vilakazi (1948) state that *iSicelankobe* means "the one who begs for boiled mealies." (Note the similarity below with one Xhosa name for the Evening Star.) The Zulu informed Callaway (1870) that the Evening Star was sometimes invisible, and sometimes seen. Jenkinson (1884), interestingly, described an event which occurred on the 7th of January 1878 when 'a bright star' appeared near the Moon at midday with the Sun shining brightly. Jenkinson was in Natal at that stage. The Africans in the area where the observation was made claimed that this celestial phenomenon "foretold the coming war" with the Zulu (the Anglo-Zulu War of 1879). Intense heat and drought prevailed at the time, which may have encouraged the prophesy. T. P. Cooper confirmed that the details provided by Jenkinson (1884) were correct. The Moon, as per T. P. Cooper, was 'a thin crescent, 13 percent illuminated', with an elevation of about 40° above the horizon. Venus, then in a crescent phase, had an apparent magnitude of –4.6 (which is about as bright as this planet can be). The Moon and Venus were in close proximity to each other.

Two early Zulu language newspapers were named after the Morning Star. These were *Jnkanyezi Yokusa* (first published in 1850), which was later succeeded by *lkwezi* in April 1861 (Maclean, 2003). Venus clearly inspired some Zulu poets. Both Nxumalo (1965) and Sikakana (1966) produced anthologies with the word i*Khwezi* in the title. A predominantly Zulu language radio station, which broadcasts to central Kwa Zulu-Natal, is Radio Khwezi.

The Pleiades: iSilimela

The Pleiades, known as the Seven Sisters (seven stars), is an open star cluster in the constellation of Taurus. The Pleiades consist of Alcyone, Celeno, Maia, Merope, Taygeta, Asterope and Electra. The name of the cluster originates from Greek mythology, with these stars representing the seven daughters of Atlas (Staal, 1961). At least six stars in the cluster are visible to the perceptive naked eye on a clear and dark night. Estimates of the total number of stars in the cluster vary from some 200 (Nicolson, 1997) to about 500 (Rudaux & de Vaucouleurs, 1967). The Pleiades, as we shall see, play an important role in southern African astronomical beliefs. This is not surprising given that the Pleiades are the best-known open cluster across the world (Nicolson, 1977). It would be interesting to discover why this is so, although the reasons for the widespread appeal of the cluster are probably lost in the mists of time. An absorbing discussion of celestial mythology in several parts of the

world is available in de Santillana and von Dechend (1999). Africa, excluding the Ancient Egyptians, is however only briefly mentioned. Themes covered in the book include the Pleiades, the Milky Way, creation and individuals climbing up into the sky (heaven) from Earth. The authors, drawing on scientific information as well as historical and literary sources, maintain that celestial myths are 'the remains of a preliterate astronomy'. Reference is made in this regard to "an exacting science whose power and accuracy were suppressed and then forgotten by an emergent Greco-Roman worldview." The authors speculate whether all such myths have "one common origin in a celestial cosmology," and whether the gods, the places where they lived and their actions, are "ciphers for celestial activity" (that is, 'a language for the perpetuation of complex astronomical data over time').

The early morning rising of the Pleiades on the north eastern horizon, during the lunar month of June–July, was of significance for the Zulu. This event marked the new year and the beginning of the agricultural season when it was time to start digging or hoeing *(Lima* = 'to dig'); or in more modern terms, to plough. The appearance of the Pleiades indicated that it was early spring (Bryant, 1905; Krige, 1950; Doke & Vilakazi, 1948). A Zulu expression states that: "The Pleiades have now fetched the diggers" (Callaway, 1870). Callaway gives a different interpretation of the Pleiades, which according to his informants, are not seen in winter. These stars only begin to appear "when the winter is coming to an end." One star is seen first, then three, and later "a cluster of stars." The Pleiades are perfectly clear when the Sun is about to rise. It is at this stage that both *iSilimela* and the year are renewed, and it is time to dig. The Pleiades, when not visible, are thought to have died (Callaway, l870).

Another version is that the appearance on the horizon of the very first star of the Pleiades was taken as the actual beginning of the new year, although this star was called *uCwazibe* (Mkando: one of James Stuart's informants cited in Webb and Wright, 1982). The star is discussed further below. The proper time for observing the Pleiades was an hour or so before daybreak (Dhlozi: another Stuart informant cited in Webb and Wright, 1982). The people cut handles for hoes and began hoeing the ground (*i.e*., *limo* or *gaca* or *qata)* as soon as they thought that the Pleiades had come into view. The first star of the Pleiades (*uCwazibe*) made its appearance in the latter part of the lunar month of *Great uluTuli* or *Great uNhlangula* or *uMaquba.* There was some argument as to whether the first star formed part of the Pleiades, or not (Webb & Wright, 1982). There was often considerable debate in southern Africa, generally, regarding the first positive identification of the rising Pleiades in winter, especially where hills obscured the horizon. Some claimed superior astronomical knowledge of the Pleiades, while others preferred to wait for additional evidence.

Celestial observations, in any event, are subject to a number of constraints, including dust in the air, and atmospheric temperature variations. Cloud cover, light in the sky (that is, the phase of the Moon), and especially the eyesight of the observer. Light pollution is a modern curse that severely restricts our view of the heavens. The visibility of the Pleiades is actually a good test for both visual acuity (sharpness of

the eyes) and the conditions of observation. Some naked-eye observers can see 10 or 12 stars in the Pleiades in optimum circumstances.

The statement that the rising once more of the Pleiades indicates that it is time for ploughing is puzzling since land preparation can only commence after the first spring rains have fallen in September-October. This fact is easily confirmed by anyone who attempts to dig a hole in their garden in June in the summer rainfall region. Great effort is required to achieve this objective due to the compact nature of the soil. There is still no enlightenment even if the lunar month of June–July, rather than the calendar month of June, is invoked. It is probably the case that the reappearance of the Pleiades gives notice that the new year, *i.e.,* the new season is in the offing, which will later be confirmed by various general indicators such as increasing air temperatures and longer periods of daylight. The spring rains supply final proof that it is once again time for agricultural activities to commence. Digging-sticks were used in historical times in South Africa for planting crops. There is clear evidence of iron smelting in KwaZulu-Natal especially, and to some extent in the Transkei, during the lron Age (Feely, 1985). The Zulu digging-stick or hoe had an iron blade with a wooden handle. It was the task of the Zulu women to undertake crop cultivation.

Other Stars

Aldebaran or *uCwazibe* is a large bright star in the constellation of Taurus (Bryant, 1905), where *cwazi* means ‘of shining brightly’ (Doke & Vilakazi, 1948). Doke et al. (1958) give *uCwazibe* as an alternative for *iSicelankobe* or the Evening Star. A conspicuous star in the constellation of Argo was referred to by the Zulu as *iNkwenkwezi* (Krige, 1950). This celestial body is actually the brightest star in the constellation of Carina, and is known as Canopus. The constellation of Argo is an ancient constellation which was subdivided in the 1920s into three separate constellations: Carina, Vela and Puppis. Canopus is a prominent temporal indicator which precedes the rising of the Pleiades, and which appears on the south-eastern horizon in the early morning in mid- to late May. In astronomical terms, this event is described as a *heliacal rising,* specifically, the rising of a star just prior to the Sun at dawn, and after a period of invisibility due to *conjunction* with the Sun. (The term conjunction refers to the alignment or close alignment of two or more celestial bodies.) Canopus disappears from view in the evening sky around the end of July, and rises once more (east of south) around the end of September at about 21:00 (C. Turk). Canopus, in early October, is a readily visible sign for star-gazers that summer is approaching (Turk, 2001).

Krige (1950) also mentions a star (*iQhubankomo* or *iNtshola*) that is a possible reference to Spica in the constellation of Virgo. The star precedes the Morning Star around September, and indicates the time when stolen cattle were carried off. The name was only used in Natal (Krige, 1950). Spica, however, does not rise in

the early morning in the east until about November. Sirius, in the constellation of Canis Major, is another candidate, and rises in the early morning in the east about mid-June. Further, Zulu celestial names are Saturn (*enye yezinkanyezi ezinkulu*) and the Southern Cross (*izinkanyezi eziyisiphambano ezulwini*) (Doke et al., 1958).

Unidentified Celestial Bodies

Two unknown stars were *Jnsansa* (Koopman = *iNtsantsa*), which was described as a bright star, as well as *isAndulela* (also a bright star), which appears at the end of autumn (Krige, 1950). The latter name was used in Natal only. Krige mentions the constellation of Pons Asinorum or *isiNdwengama,* which likewise cannot be identified.

The Swazi

The Swazi word for a star or planet is *inkhanyeli* (plural = *tinkhanyeti)* (Rycroft, 1981). Very little appears to have been written on Swazi celestial beliefs. Miller (1979) stated that only the Morning Star and the Evening Star were of primary importance for the Swazi. The only specific star mentioned by Kuper (1961) is one which is seen in the Swazi lunar month of *Lweti* (November). This star is said to be visible "when women begin work in [the) early morning." It is not impossible that the star could be Venus in the guise of the Morning Star (see *Likhweti* below). The Swazi, when setting off early on a long journey (in the old days), used the Morning Star as a means of determining direction (D. Ntiwane: an informant interviewed by W. Williams). The appearance of the Pleiades or *silimela* once signalled the time to start ploughing (Vail & White, 1991).

It is apparent from the description of the Feast of the First Fruits ceremony or *Jncwala,* provided by Kuper (1961), that the "position of the stars" is ancillary to the Sun and the Moon in determining the timing of the ceremony. It is evident that a celestial regularity is required over the years, which precludes any of the planets. Vail and White (1991), nevertheless, state that the timing of *Jncwala* is indicated by the position in the sky of the Morning Star. One possible stellar candidate is Orion, more specifically *Orion's Belt*, which as indicated was known and named by the Zulu. Orion can be seen without any difficulty above the eastern horizon mid-evening during December (Fairall, 2006). The lack of data on the stars in Swazi culture has been attributed by some in present-day Swaziland to the secrecy surrounding the innermost workings of *lncwala.* It is strange, therefore, that information on the role of the Sun and the Moon in this ceremony is readily accessible in scholarly journals and books. Also strange is that celestial information is available for the Zulu, who can be said to be the "first cousins of the Swazi."

It is the opinion of the present author that Swazi astronomical data were simply never recorded, or were indeed recorded, but have been lost. Another possibility is

that the information is to be found in some publication or publications written in siSwati, and never translated into English.

Enquiries made in Swaziland revealed the following tentative celestial terms. The informants were mainly elderly Swazi women. No guarantee can be given regarding the accuracy or antiquity of the information, which was kindly supplied by D. Ntiwane; P. Mamba-Mnisi (facilitated by W. Williams); and by W. Williams.

- *Likhweti* = Venus as the Morning Star, which is a star seen when summer is approaching (P. Mamba-Mnisi). *Likhweti* is the correct term and spelling for the Morning Star (Venus) according to J.J. Thwala;
- *uMtsentse* = the Milky Way (P. Mamba-M nisi);
- *Siphambano* = this word, given the Zulu term, could be the Swazi name for Orion's Belt. According to P. Mamba-Mnisi, however, the word refers to any type of cross, including a religious symbol, and could perhaps be applied to the Southern Cross;
- *uMushi wenkhosatana* = the Southern Cross (D. Ntiwane);
- *Sicelankhobe* = Venus as the Evening Star. The name was taken from the title of a book on Swazi folklore, which was written by a Swazi author (Mabaso, 1992);
- A shooting star = *inkanyeti iyakhweba:* literally 'a star running fast' (P. Mamba-Mnisi; W. Williams);
- A lunar eclipse = *inyanga sitsekile* or *inyanga iyashobela:* literally 'the moon taken or the moon gone down' (P. Mamba-Mnisi; W. Williams);
- A solar eclipse = *lilanga sitsekile* or *lilanga iyashobela:* the same meaning as for a lunar eclipse (P. Mamba-Mnisi; W. Williams);
- The winter solstice = *intfasahlobo:* literally "leaving winter and going into summer" (P. Mamba-Mnisi; W. Williams);
- The summer solstice = *intfasabusika:* literally "leaving summer and going into winter" (P. Mamba-Mnisi; W. Williams); and
- The equinoxes = *ekhatsi nelihlobo:* literally "the middle of summer" and *ekhatsi nebusika:* literally "the middle of winter" (P. Mamba-Mnisi; W. Williams).

The Xhosa

It seems that the Xhosa, historically, did not differentiate between stars and planets. The Xhosa referred to the stars collectively as *inkanyisi* or fireflies (A.P. Dold). Astronomy, as per Fischer (1985), is thought of by the Xhosa in a more recent context as *inzululwazi ngeenkwekwezi* or 'knowledge of the heavens and the stars'. The Xhosa in the past, according to Hodgson (1982), never gave much thought to cosmology since the heavenly bodies did not intrude in their lives in the same way as thunder and lightning. The Xhosa only took note of a few prominent stars as well as the Sun and the Moon. There was no speculation about the nature of the heavenly bodies or their movements, and neither were they personified. It was once considered disrespectful to point a finger at an elderly person, at the grave of an ancestor, or at

the sky which was the dwelling place of Qamata (Hodgson, 1982). Anyone wishing to point at something in the sky did so by means of a bent index finger or a fist. Hodgson noted that the Qamata taboo was still widely observed by the Xhosa in the late 1970s. A possibly more contemporary version is that the stars represent the spirits of the dead, and should not be directly pointed at (T.E. Matomela). Venus features, as for the Zulu, with Canopus, the Pleiades, Jupiter, the Milky Way, Orion's Belt and Sirius.

Venus

The Xhosa, like the Zulu, regarded Venus as two distinct celestial bodies. The Xhosa Morning Star is *iKhwezi* (Kropf & Godfrey, 1915). This star was a sign to the Xhosa that dawn was coming (P. Cimi). For those going to the fields to plough or to plant, it was the time to prepare for the new day. Travelers embarking on a long journey set out at this time, in the full knowledge that it would soon be light. It was also at this time that traditional healers *(iigqirha)* went down to the river (before anyone else) to wash, or to prepare for ritual ceremonies to be held later in the day. The traditional healers, in the latter case, communicated with the ancestral spirits or *iziNyanya* resident below the water in the river. It was essential that the healers were not disturbed during their preparations, failing which, the rituals might not be successful. It was therefore important for the healers to be the first to arrive at the river (P. Cimi).

Kopke (1982), interestingly, describes a two-stage Morning Star, as per the Zulu. Kopke referred to the morning twilight or *isifingo* when the first star, *iKhwezi lokuqala,* rises above the eastern horizon. This is followed some time later by the second star, *iKhwezi lesibini.* No further details are available in Kopke (1982). T.E. Matomela states that the first star, *iKhwezi lokusa* (note different spelling), is associated with travelers as well as diligence (*i.e*., is the signal for the daily household chores to commence). Matomela confirms the spelling of the second star as *iKhwezi lesibini,* although he maintains that this star is Venus when seen at midday. The sighting of Venus in full sunshine is not an everyday occurrence, however. Soga (1931) refers to *iKhwezi lokusa* as Venus in the form of the Morning Star, with *iKhwezi* as one name for the Evening Star.

The earliest known writings in Xhosa by a Xhosa are said to concern the story of Ntsikana, a Xhosa prophet and poet (Hodgson, 1984). This account was written by his son, William Kobe Ntsikana, and two of Ntsikana's disciples. The material appeared in the Glasgow missionary magazine *Ikwezi* which was published in Lovedale. The magazine had a brief existence (consisting of four issues) in the period August 1844 until December 1845, before being replaced by another publication (Hodgson, 1984).The Xhosa Evening Star is *uCelizapholo* or the "one who asks for milk" (Kropf & Godfrey, 1915). A different name is *uNocelizapholo*, or "asking for the leavings of milk in the cow's udder." The star was so-named since it appears (shines) at milking time. Another name for the Evening Star, as per Kropf

and Godfrey, is *isiCelankobe* ("one who asks for cooked millet"). There are very few people at the river at this time of the day (P. Cimi). All is quiet with no birds calling. This is a good time to communicate with the ancestors, and is also an ideal time for certain rituals to be performed. This is likewise the time when youths undergoing initiation (circumcision) go to the river to wash. Initiates, alternatively, wash very early in the morning in similar reclusive circumstances (P. Cimi). A further name for the Evening Star is *uMadingeni* (T.E. Matomela). Matomela refers to Venus in this context as a dating star. The inference here is that lovers only have a certain amount of time together while Venus can be observed.

Canopus

It is in mid- to late May that Canopus or *uCanzibe* becomes readily visible on the south eastern horizon, as described, just before sunrise. Canopus can be seen for a few minutes at this time of day when the morning light has already obliterated the other stars from view (Kopke, 1982). The appearance of the star indicates the time for harvesting (Kropf & Godfrey, 1915). The star can also be said to be the harbinger of winter (T.E. Matomela). Canopus gives its name to the Xhosa lunar month of May or *ekaCanzibe* (Kropf & Godfrey, 1915; Kopke, 1982).

The Pleiades

The Xhosa name for the Pleiades (*isiLimela*) means 'the one that ploughs for', *i.e*., that which ushers in the ploughing season (Soga, 1931). The traditional Xhosa year began in June when the Pleiades were sighted once more in the early morning (Peires, 1981). These stars signaled the time when the wooden digging-sticks or hoes were hauled out in the old days, or in more modern terms, when ploughing began. Kropf and Godfrey (1915) state that the rising of the Pleiades signifies that spring has arrived, and that it is the time for ploughing wheat. This was also the time of the year when initiation ceremonies (*ulwaluko*) were performed (Tshabe & Shoba, 2006). Kopke (1982) indicated that June was the month when circumcision initiates had their "coming out" ceremonies, which was the last rite before the initiates were regarded as adults. Kopke (1982) drew a parallel between the advent of the new year, as signified by the Pleiades, and the new start in life of the young adult men. A Xhosa man once calculated his age (manhood years) according to the number of winters (number of appearances) of the Pleiades since his initiation, or the years elapsed since his time of separation or seclusion in the initiation lodge (Tshabe & Shoba, 2006; Kopke, 1982). Kopke (1982) suggested that the closeness on the horizon of the rising Pleiades and the rising Sun at the winter solstice was noted by the Xhosa. The Xhosa may have used the most northerly position of the Sun, or a close approximation thereto, as a temporal and logistical marker to observe the reappearance of the Pleiades. The Pleiades, at the winter solstice, rise about 18° to the left of the Sun, while looking east (T.P. Cooper). The sighting of this star cluster,

resembling seeds, gives its name to the Xhosa month of June or *eyeSilimela* (Kopke, 1982). An interesting concept was raised by Hammond Tooke (1888) who suggests that the reference to hoeing time, "the beginning of spring," and the first appearance of the Pleiades may date to past centuries when the Xhosa, or their forebears, lived in "more northern latitudes."

The theoretical land in question, then, would be one where *the first* rising of the Pleiades in June coincided with the *first* or significant seasonal rains after a lengthy dry period, enabling the breaking of the soil to commence. Much obviously depends on the rainfall regime in this hypothetical locality, which could possibly be surmised to be somewhere in south central Africa or East Africa. Evidence cited by Hammond Tooke (1888) in this regard is that the Swahili word for the Pleiades is *kilimia,* where *kilimo* refers to cultivation or planted crops, and *kulimo* means 'to hoe or cultivate'. Are we perhaps, in certain instances, receiving 'dislocated information' from some 'golden age' of the past, before the group concerned migrated to South Africa from elsewhere in Africa?

Migration raises another issue. Did the Xhosa antecedents (and the antecedents of other Bantu-speakers) set out to travel in a southerly direction by design? If so, this implies knowledge of a "north" and a "south" or an "up Africa" and a "down Africa." It can only be speculated that use was made of the Sun for directional purposes while actually traveling. This suggestion, in turn, implies a degree of navigational skill attuned to the Sun. It was obviously dangerous to move around at night, which more or less excludes the stars as a way-finding mechanism.

There appears to be some divergence of opinion in South Africa regarding the *timing* of the Pleiades as an indicator that land preparation should begin. The Pleiades clearly operated as a signal for certain events for the Xhosa, although the start of hoeing or ploughing in June or July, in reality, cannot be one such function. Another line of reasoning, perhaps, is that the first rising of the Pleiades was the signal for land clearing to commence, prior to actually digging the soil later in the year. It is highly unlikely that the Xhosa would undertake such a task so soon after the harvest. The post-harvest phase in winter was a time of rest and social interaction. An additional factor is that cattle are allowed to graze in the fields following the harvest, effectively achieving a degree of land preparation

Further Celestial Objects

The Xhosa sometimes associated Jupiter with travelling at night. The planet is visible throughout the night in certain months, and "somehow seemed to guide the traveler" (Fairall, 2006). There are two Xhosa names for Jupiter (T.E. Matomela). The first, according to Matomela, is *iCandabusuku* or "that which crosses the sky." The planet was associated with a vessel or container that carries benevolent ancestral spirits who guard the people against evil influences. Another name for Jupiter, as per Matomela, is *iMbhalibusuku* or "that from which night stories are told." The planet

was occasionally pointed out by night travelers who related stories about the planet. It was said that Jupiter expelled evil spirits from the celestial sphere, who became visible as shooting stars. McLaren (1955) described Jupiter as *lngcand'ubusuku* or "the traverser of the night." McLaren (1955) also used a second term, *Imbal'ubusuku* or "the recorder of the night," although it is very probable that Jupiter was meant in this case. The Xhosa name for Sirius is *iNgqaqhawuli* or *iQhawe* (T.E. Matomela). The Milky Way is known by the Xhosa as *umnyele wezulu* or "the backbone of the heavens" (Fischer, 1985). Soga (l931) refers to the Milky Way as "the raised bristles along the back, as on an angry dog." The analogy, irrespective of the description used, is apparent. The row of stars forming Orion's Belt is referred to as *amaRoza* (Kropf & Godfrey, 1915), or "a row of beads" as per Hammond Tooke (1888).

McLaren (1955) described Canopus as *Isoka lasekhohlo*, or "the suitor on the left hand," and Sirius as *Isoka lasekunene,* or "the suitor on the right hand." The given celestial scenario is evident for about a month towards the end of May or the beginning of June, when Canopus and Sirius set in the evening in the west (T.P. Cooper; C. Turk). Both stars are very low down on the horizon, at more or less the same elevation. The observer facing in a south westerly direction will see Canopus on his left and Sirius on his right (T.P. Cooper; C. Turk). The Xhosa, it seems, were clearly intrigued by this stellar arrangement, which was evident at harvest time. Readers are reminded that Sirius (right hand) is the brightest star in the night sky, while Canopus (left hand) is the second brightest star.

Still puzzling, however, is the use of the term 'suitor'. It is not impossible that the positions of Canopus and Sirius, at the time described, reminded the Xhosa of the physical or spatial layout of a typical polygynous household (*umzi*) with a number of dwellings. The principal house of the household faced the entrance to the cattle enclosure or *ebuhlanti* (Hoernle, 1966). All the other houses were arranged on either side of the principal one in a semi-circle. Each family or 'house' (*indlu*) formed an independent unit with its own property. Two wives were of significance, namely, the first wife married or principal wife (*inkosikazi*), and the 'right-hand wife' (*umfazi wasekunene*), so-called from the position of her house in the household complex. Any other wives were affiliated to the two principal wives as subordinates, and were known as *Qadi.* The Xhosa counted right and left from the perspective of someone looking out from the principal door (vantage point) *towards* the cattle enclosure (open space). The layout of the *umzi* had several important implications denoting seniority and, amongst other things, inheritance (Hoernle, 1966). It is suggested, then, that the layout of the household may have had relevance for the configuration of Sirius and Canopus. Canopus, although not as bright as Sirius, is of greater significance for the Xhosa in an agricultural and thus household sense.

The following celestial names were derived from Bud-M 'belle (1903). The names refer to the Xhosa-speaking people in the eastern Cape, including the Xhosa. Some of the names given by Bud-M'belle were translated directly from Latin (possibly by Bud-M'belle) and are not indigenous, although they may have been used by mission-

educated Xhosa speakers. All such names, which are of constellations, appear in the first list below. The exact spelling, as per Bud-M'belle, has been retained:

- *1-Nja 'nkulu* = Canis Major or the Greater Dog;
- *1-Nja encinane* = Canis Minor or the Lesser Dog;
- *I-Sik epe sika Ago* = The ship Argo;
- *1-Sitya* = Crater or the Cup/Beaker;
- *1-Sitebe* = Ara or the Altar;
- *1-Ntlanzi zase zantsi* = Piscis Austrinus (Piscis Australis) or the Southern Fish;
- *1-Sitsaba sase zantsi* = Corona Australis or the Southern Crown;
- *1-Hobe /ika Nowa* = Columba Noarchi (officially known as Columba or the Dove);
- *U-Mnqamlezo,vase zantsi* = Crux Australis (now simply called Crux or the Southern Cross);
- *U-Pondo 'lunye* = Monoceros or the Unicorn.

Further names provided by Bud-M 'belle (1903), although already discussed above, are as follows:

- *U-Canzibe* = The large reddish star Saturn, which is visible in the southern hemisphere in winter. Bud-M'belle was mistaken in this case. The true identity of the star, as previously indicated, is Canopus;
- *U-Cel-izapolo* = Venus as an evening star. The Abambos (the Mfengu) call it *isi-Cela nkobe;*
- *Ama-Roza* = The constellation (*i.e*., asterism) of stars called Orion's Belt;
- *Isi-Limela* = The Pleiades, which announce the time for ploughing.The planet Jupiter. It is unclear why Bud-M'belle believed that the Xhosa name also applied to Jupiter;
- *U-Mnyele* = The Milky Way in the sky;
- *l-Kwezi* = Venus as an evening star; and
- *1-Kwezi-lokusa* = Venus as a morning star.

Bud-M'belle (1903) referred to a transit of Venus on the 9th of December, 1874, as one of the historic events known or experienced by Xhosa-speakers. The rare transit was of Venus across the Sun. The transit began at 03:49 and was thus already underway at sunrise (T.P. Cooper). This phenomenon could easily be seen with the naked eye just as the Sun came up. Venus would have appeared as a round black hole 'within' the Sun.

CONCLUSION

It is encouraging to note that selected astronomical topics are now covered in part of the South African school syllabus. Some of the material in my recent text *Venus Rising: South African Astronomical Beliefs, Customs and Observations,* from which

this chapter is derived, could be used to stimulate a deeper interest in astronomy at schools and in indigenous knowledge.

REFERENCES

Alcock, P. G. (2010). *Rainbows in the mist: Indigenous weather knowledge, belief, and folklore in South Africa.* Pretoria: South African Weather Service.

Becker, P. (1962). *Path of blood: The rise and conquests of Mzilikazi founder of the Matabele Tribe of Southern Africa.* London: Longmans.

Becker, P. (1972). *Rule of fear: The life and times of Dingane King of the Zulu.* London: Panther.

Bryant, A. T. (1905). *A Zulu-English dictionary with notes on pronunciation, a revised orthography and derivations and cognate words from many languages; including also a vocabulary of Hlonipa words, tribal-names, etc., a synopsis of Zulu grammar and a concise history of the Zulu people from the most ancient times.* Pinetown: Mariannhi 1l Mission Press.

Bryant, A. T. (1929). *Olden times in Zululand and Natal: Containing earlier political history of the eastern-Nguni clans.* London: Longmans.

Bryant, A. T. (1949). *The Zulu people as they were before the white man came.* Pietermaritzburg: Shuter and Shooter.

Bud-M'belle, I. (1903). *Kafir scholars companion.* Lovedale: Lovedale Missionary Press.

Callaway, H. (1868). *Nursery tales, traditions, and histories of the Zulus, in their own words, with a translation into English, and notes* (Vol. l). Springvale: John A. Blair.

Callaway, H. (1870). *The religious system of the Amazulu: lzinyanga Zokubula; or, divination, as existing among the Amazulu, in their own words, with a translation into English, and notes.* London: TrUbner and Company.

Cole-Beuchat, P.-D. (1957). Riddles in Bantu. *African Studies, 16*(3), 133–149.

Colenso, J. W. (1905). *Zulu-English dictionary* (4th Rev. ed). Pietermaritzburg: Vause, Slatter and Company.

Cope, J., & Krige, U. (Eds.). (1968). *The penguin book of South African verse.* Harmondsworth: Penguin.

Dalton, J. (1987). *An introduction to the larger mammals of Southern Africa.* Durban: Wildlife Handbook, Natal Branch of the Wildlife Society of Southern Africa.

Daly, R. (2000, October). A conspiracy of green. *Getaway,* 66–79.

Doke, C. M. (1928). Lamba ideas of cosmogony, *South African Geographical Journal, 11*, 18–21.

Doke, C. M. (1945). *Text-book of Zulu Grammar* (4th ed.). London: Longmans. [Data derived from Rudolph (1948).]

Doke, C. M. (1947). Bantu wisdom -lore. *African Studies, 6*(3), 101–120.

Doke, C. M., Malcolm, D. M., & Sikakana, J. M. A. (1958). *English-Zulu dictionary.* Johannesburg: Witwatersrand University Press.

Doke, C. M., & Vilakazi, B. W. (1948). *Zulu-English dictionary.* Johannesburg: Witwatersrand University Press.

Fairall, A. (2006). *Stargazing from game reserves in Southern Africa.* Cape Town: Struik Nature.

Faye, C. (1923). *Zulu references for interpreters and students.* Pietermaritzburg: City Printing Works.

Feely, J. M. (1985). Smelting in the iron age of Transkei. *South African Journal of Science, 81*(1), 10–11.

Feris, M.-L. (2002, October). Darkening of day stirs ancient myth. *Daily News,* 11.

Fischer, A. (1985). *English-Xhosa dictionary.* Cape Town: Oxford University Press.

FitzGerald, M. (2005). *Stars of the Southern skies: An astronomy field guide.* Johannesburg: Witwatersrand University Press.

Fraser, B. (1995). Presidential address: Astronomy in the lives of the indigenous people of southern Africa. *Monthly notes of the Astronomical Society of Southern Africa [MNASSA], 54*(11/12), 126–131.

Godfrey, R. (194l). *Bird-lore of the Eastern Cape Province* (Bantu Studies Monograph Series No. 2). Johannesburg: Witwatersrand University Press.

Golson, J. (Ed.). (1972). *Polynesian navigation: A symposium on Andrew Sharp's theory of accidental voyages* (3rd ed.). Wellington: A.H. and A.W. Reed.

Haggard, H. R. (1990). *King Solomon's mines* (K. J. Saycell & A. D. Donker, Eds.). Johannesburg: A. P. B.

Hewitt, R. (2008). *Structure, meaning & ritual in the narratives of the Southern San.* Johannesburg: Wits University Press.

Hodgson, J. (1982). *The god of the Xhosa: A study of the origins and development of the traditional concepts of the supreme being.* Cape Town: Oxford University Press.

Hodgson, I. (1984). Chapter two. The genius of Ntsikana: traditional images and the process of change in early Xhosa literature. In L. White & T. Couzens (Eds.), *Literature and society in South Africa* (pp. 24–40). Cape Town: Maskew Miller Longman.

Hoernle, A. W. (1966). Chapter IV. Social organization. In I. Schapera (Ed.), *The Bantu speaking tribes of South Africa: An ethnographical survey* (pp. 67–94). Cape Town: Maskew Miller.

Hoffmann, C. (1925, November 7). The natives and astronomy. *The South African Nation,* p. 14. [Data derived from Warner (1996).]

Hoffmann, C. (1932). Sotho-Texte aus dem Holzbusch-Gebi rgein Transvaal: Naturgeister und Zauberkrafte. *Zeitschriftfur Eingeborenen-Sprachen, 22*(3), 161–179. [Data derived from Breutz (1969).]

Holbrook, J. C., Medupe, R. T., & Urama, J. O. (Eds.). (2008). *African cultural astronomy: Current archaeoastronomy and ethnoastronomy research in Africa.* New York, NY: Springer.

Jenkinson, T. B. (1884). *Amazulu. The Zulus, their past history, manners, customs, and language, with observations on the country and its productions, climate, etc. the Zulu war, and Zululand since the war.* London: W. H. Allen.

Jones, A. B. (Ed.). (2007). *Sky guide Africa south 2007: Astronomical handbook for Southern Africa.* Cape Town: Astronomical Society of Southern Africa.

Junod, H. A. (1913). The condition of the natives of South-east Africa in the sixteenth century, according to the early Portuguese documents. *South African Journal of Science, 10*, 137–161.

Junod, H. A. (1927). *The life of a South African tribe: 1. Social life,* 559 pp.; *JI. Mental Life,* 660 pp., (2nd ed.). London: Macmillan.

Junod, H. P., & Jaques, A. A. (1936). *Vutlharibya vaTonga (Matshangana), or, The wisdom of the Tonga-Shangaan People.* Cleveland: Central Mission Press.

Koopman. A. (2002). *Zulu Names.* Pietermaritzburg: University of Natal Press.

Kopke, D. (1982). Concepts of time among the Xhosa. *Fort Hare Papers, 7*(4), 229–238.

Krige, E. (1931). Agricultural ceremonies and practices of the BaLobedu. *Bantu Studies, 5*(3), 207–239.

Krige, E. J. (1950). *The social system of the Zulus* (2nd ed.). Pietermaritzburg: Shuter and Shooter.

Krige, E. J., & Krige, J. D. (1980). *The realm of a rain-queen: A study of the pattern of Lovedu Society.* Cape Town: Juta.

Kropf, A. (1879). The gods of the Basuto. *[South African] Folk-Lore Journal, 1*(2), 32–33.

Kropf, A., & Godfrey, R. (1915). *A Kafir-English dictionary* (2nd ed., R. Godfrey, Ed.). Lovedale: Lovedale Mission Press.

Kruger, F. (1937). Tlokwa traditions. *Bantu Studies, 11*(2), 85–115.

Kruger, J., & Pooe, I. (2010, July). Antuntulele-a Setswana lullaby. *The Talking Drum,* (33), 11–13.

Kiihle, L. (2002, August). The moon is empty. *South African Country Life,* p. 129.

Kuhn, G. (1929–1930). Sotho-Sprichworter. *Zeitschrtft fiir Eingeborenen-Sprachen, 20*(2), 120–148. (Northern Sotho material translated into English by P.S. Groenewald.)

Kunene, M. (1982). *The ancestors & the sacred mountain.* London: Heinemann.

Kuper, A. (1978). Fourie and the Southern Transvaal Ndebele. *African Studies, 37*(1), 107–123.

Kuper, H. (1944). A ritual of kingship among the Swazi. *Africa, 14*(5), 230–256.

Kuper, H. (1945). The marriage of a Swazi princess. *Africa*, *15*(3), 145–155.

Kuper, H. (1961). *An African aristocracy: Rank among the Swazi.* London: Oxford University Press.

Kuper, H. (1963). *The Swazi: a South African kingdom. Case studies in cultural anthropology*. New York, NY: Holt, Rineha11and Winston.

Kuper, H. (1972). A royal ritual in a changing political context. *Cahiers d 'Etudes Africaines, 12*(48), 593–615.

Laband, J. (1995). *Rope of sand: The rise and fall of the Zulu kingdom in the nineteenth century.* Johannesburg: Jonathan Ball.

Maclean, I. S. (2003). 'The twin pillars of heathenism': American missionaries, Bishop Colenso and converts in conflict-polygamy and *Ukulobola* in nineteenth-century Natal and Zululand, South Africa. In J. A. Draper (Ed.), *The eye of the storm: Bishop John William Colenso and the crisis of biblical inspiration I* (pp. 265–292). Edinburgh: T. & T. Clark Publishers.

Mayall, R. N., & Mayall, M. W. (1954). *Olcott s field book of the skies* (4th ed.). New York, NY: G. P. Putnam's Sons.

Mbiti, J. S. (1970). *African religions and philosophy.* London: Heinemann.

McCosh, F. W. J. (1979). The African sky. *NADA, 12*(1), 30–44.

Samuelson, R. C. A. (1923). *The king Cetewayo Zulu dictionary.* Durban: Commercial Printing Company.

Samuelson, R. C. A. (1974). *Long, long ago.* Durban: T. W. Griggs.

Sikakana, J. M. (1966). *iKhwezi likaZulu* (Bantu Treasury Series No. 16). Johannesburg: Witwatersrand University Press.

Snyman, J. W., Shole, J. S., & le Roux, J. C. (1990). *Diki.finare ya Setswana English Afrikaans dictionary Woordeboek* (1st ed.). Pretoria: Via Afrika.

Snyman, M., Ntuli, B., & Ntuli, D. (2009). *The crocodile who swallows the sun and other stories of the southern sky.* Pretoria: Southern Science.

Sobukwe, R. M. (1971). A collection of Xhosa riddles. *African Studies, 30*(2), 117–150.

Soga, J. H. (1930). *The South-Eastern Bantu: Abe-Nguni, Aba-Mbo, Ama-Lala.* Johannesburg: Witwatersrand University Press.

Soga, J. H. (1931). *The Ama-Xosa: Life and customs.* London: Lovedale Press, Lovedale and Kegan Paul, Trench, TrUbner.

Staal, J. D. W. (1961). *Patterns in the sky.* London: Hodder and Stoughton.

Stewart, D. (1994). *Daughter of the moonlight and other African tales.* Cape Town: Struik.

Tshabe, S. L., & Shoba, F. M. (Eds.). (2006). *The greater dictionary of isiXhosa* (Vol. I). Alice: University of Fort Hare.

Turk, C. (2001). *Sasol first field guide to skywatching in southern Africa.* Cape Town: Strnik.

Tyrrel, I. B., & Jurgens, P. (1983). *African heritage.* Johannesburg: Macmillan South Africa.

Webb, C. de B., & Wright, J. B. (Eds.). (1982). *The James Stuart archive of recorded oral evidence relating to the history of the Zulu and neighbouring peoples* (Killie Campbell Africana Library Manuscript Series No. 3, James Stuart Archive Vol. 3). Durban: University of Natal Press, Pietennaritzburg and the Killie Campbell Africana Library.

Webb, C. de B., & Wright, J. B. (Eds.). (1986). *The James Stuart archive of recorded oral evidence relating to the history of the Zulu and neighbouring peoples* (Killie Campbell Africana Library Manuscript Series No. 4, James Stuart Archive Vol. 4). Durban: University of Natal Press, Pietermaritzburg and the Killie Campbell Africana Library.

Webb, C. de B., & Wright, J. B. (Eds.). (1987). *A Zulu king speaks: Statements made by Cetshwayo kaMpande on the history and customs of his peoples* (Killie CampbeII Africana Library Reprint Series No. 3). Durban: University of Natal Press, Pietermaritzburg and the Killie Campbell Africana Library.

Webb, C. de B., & Wright, J. B. (Eds.). (2001). *The James Stuart archive of recorded oral evidence relating to the history of the Zulu and neighbouring peoples* (Killie Campbell Africana Library Manuscript Series No. 5, James Stuart Archive Vol. 5). Pietermaritzburg: University of Natal Press.

Werner, A. (1912). Note on Bantu star-names. *Man, 12*, 193–196. (This short article is designated as No. 105.)

Werner, A. (1933). *Myths and legends of the Bantu.* London: Harrap.

PART 3

ARCHITECTURE

PATRICK DARLING

10. NIGERIAN WALLS AND EARTHWORKS

There are more town walls in Nigeria than in all the rest of West Africa. In the field, they inevitably aroused a curiosity about where they led; how they were built; how long they were; where the gateways or entrances were and where their related pathways led; whether their cross-profiles changed; what they enclosed and what they kept out; when they were built and why. The terms used for their various modes of construction and delineation are explained below.

Modes of Construction

Dump ramparts with tip lines of darker topsoil evident in the largely red-brown subsoil banks are the most frequent form of linear earthwork in rainforest and gallery forest—the vertical-sided ditches observed in parts of Sungbo's Eredo, Old Owu and Owo 'walls' probably once being the initial mode of construction of all such earthworks. Oral traditions claim that work was supervised by old men; young men dug the ditch with wooden spades to fill baskets; women carried the full baskets up and emptied them to form banks on the inner side of the ditch; and children returned the baskets (Darling, 1984, pp. 51–52). On average, these dump ramparts were 3 metre deep from bank top to ditch bottom: they range from shallow trace diggings now less than 1/2 metre deep to massive 12- to 20-metre deep constructions around the more powerful past centres, such as Benin and Ijebu-Ode.

Coursed mud walls for defensive town walls occur at Koso, Ipapo Ile, Old Oyo and Donga in the Guinea savannah, as well as in old Kambari and Kamuku settlements in the Sudan savannah. Each course was made of puddled mud (trampled by foot) held in by wooden boards, then allowed to dry over several days before the next course could be laid. At Koso, the 6-metre high wall tapers from nearly 2 metres wide at the base to under 1/2 a metre wide at the top; and holes through the wall show where long sticks were pushed through the wall to hold the boards together while each course dried—the holes are often too high to be loopholes. At the end of each section laid, the courses were made to overlap slightly in a zig-zag fashion, presumably in an attempt to increase lateral bonding, though this was not always successful.

Natural coursed rubble walls are alternating layers of mud and stone rubble; in practice they were a highly flexible form of construction, able to adapt to changing geological conditions ranging from cubic lateritic blocks, to thin slabs of vertically

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slanting or horizontal schist, to gritty clays. The best examples of this technique to date have been observed at Rano and Birnin Gwari.

Tubali walls made from sun-dried, pear-shaped, mud bricks set in a mud mortar matrix were the most common mode of construction in northern Nigeria. At Bin Yauri, a mud-plastered free-standing *tubali* wall was juxtaposed as a revetment to the inner ditch side, the bank parapet and then as a free-standing wall on top: the Kano wall was of a similar basic construction mode. At Old Ningi, the outer and inner defensive walls were 2 metre-high, free-standing, mud-plastered *tubali* walls with rounded castellations on top of a 1 metre-high stone parapet. This technique was viable in dry areas but required unsustainable high maintenance in wetter areas, *e.g.*, MOTNA's version of the Kano wall at Jos.

Laterite block walls with a white clay mortar have been observed at Banga. At Surame, one of Africa's largest stone structures, there is an oral anecdote of an 8 kilometer-long bucket chain to bring water to make the mortar of its massive, vertical walls, the laterite blocks of which faced the inner side of the ditch and bank similar to the more ancient fortifications at Gungu. It is impossible to check if mortar was applied to the extensive *tara mahara* laterite block barrier around Katsina because the whole massive feature was expropriated to build a new road. These north-west Nigerian laterite block walls have connections with Songhai influence.

Stone walls occur only where the raw material is readily available, mainly in hills. These are of dry-stone construction without any evidence of mortar; and the most spectacular example is at Nigeria's first UNSECO World Heritage Site at Sukur where a 6- to 7-metre high free-stone wall encircles the royal enclosure; stone slabs create walkways over the mountains, and monoliths and stone gate pillars have symbolic meanings. At Old Ningi, a plastered *tubali* mud wall was based on a 1-metre high parapet of unplastered stone.

Fired brick constructions have been observed in many Kanuri capitals and palaces in north-east Nigeria, but the subsequent recycling of most visible bricks into new houses means that any evidence for mortar between the brick wall constructions has gone—although it would almost certainly have been a necessary structural component. A fired brick from the Gambaru palace (12°22'N 14°13'E) was 19.5 cm × 10.8 cm × 7.2 cm and weighed 1545.8g (British Museum, Blythe Road storerooms, Ref. Af1908-10-6.1).

Mud plastering was found on most of the above basic mud construction modes; and this helped to present a smooth, virtually unscalable face to the attacker. No direct evidence of such plastering has been observed on laterite and stone constructions. The ingredients mixed with the plaster included blood, skulls, gold-dust, palm-oil, and/or straw—a mix of the spiritually symbolic and the practical.

Earthwork Configurations

Orthodox terminology: The descriptive terms for linear earthworks often fail to make the vital distinctions necessary for interpretation. 'Univallate' just means

'one bank' without denoting whether this represents a collapsed mud wall or a dump rampart. 'Bivallate' (double-banked) cannot easily be distinguished from 'bifossate' (double-ditched): both have various possible combinations, as do multivallate earthworks with three or more banks. Most univallate earthworks have a ditch dug on the outside: those with a ditch on the inside are termed 'henges' and were probably once perceived as retaining the restless spirits of those who died on sacred sites or in slave-enclosures. Relevant plans and cross-sections are included in the text to minimize confusion from this imprecise terminology.

'Concentric' is used where earthworks or walls lie inside and parallel within other earthworks or walls—the most dramatic examples of which come from Gajumbra, from near Bama, from Owo and from Old Oyo. Concentric banks were often fortified with pallisade fences and helped create the distance necessary to minimize the impact of thrown weapons—spears/javelins, slingshots and arrows.

Where earthworks or walls add an enclosures that join an inner enclosure at two points, the extra outer enclosure is referred to as an accretionary loop: this ranges from simple one-looped enclosures, to much more complex multiple-looped enclosures. In the case of the Benin earthworks, the resulting extension of demarcated territorial boundaries of adjacent settlements creates no-man's-lands varying from narrow *cordons-sanitaires* in the central core areas to kilometre-wide bands on the periphery, so creating a vast reticulated pattern over the rainforest landscape.

Circular or ovoid enclosures are rarely perfectly circular or oval due to survey problems through awkward vegetation. They tend to be found around early large settlements and in the very small C19th Kare-Kare forts. In the smaller settlements, the frequent absence of parapets indicates that defense usually concentrated on the gateways rather than along the high walls.

Gateways were the perceived weakness—the points at which most conquests occurred in traditional accounts throughout Nigeria. As a result, northern Nigeria's gateways were often so narrow that in the nineteenth century, Barth noted that a laden camel could not pass through; and the gates themselves were made of termite-resistant borassus palm, reinforced with iron strips. Complicated gate plans are found in the middlebelt at Old Oyo and further south, where timber has long since disappeared, more reliance seems to have been placed on drawbridge planks over deep ditches and on burying ritual pots beneath the gateways.

Earthworks or walls with rectangular enclosures will be referred to as rectilinear although this definition includes squares, near squares and rectangles. These straight-sided plans enabled effective enfilading fire along the walls, which helped defend against cavalry attacks, which began about five centuries ago. The transition from circular to rectilinear is expressed dramatically by the abandonment of Gajumbra, for a new site a few kilometres away at Karodi, with its massive rectilinear rampart.

Benin Earthworks

Benin-centric history perceived the ancient ditches around its city as being a series of concentric 'moats' or 'walls' dug to protect the city—the innermost of which was dug by the 14th century Oba Oguola, in response to the one dug at Udo, and then deepened up to 20m by Oba Ewuare in the mid-15th century (Egharevba, 1937).

Connah sent out two survey teams to map these 'walls' in the 1960s: each team of six had two men clearing the undergrowth along the bank top, two men holding a chain, one man holding an eight-foot high surveying pole, and another man taking readings to the nearest half degree with a prismatic compass. With no way of avoiding thick vegetation patches, and with the chain snagging on the cut undergrowth stalks, each team averaged only 400 m a day, with the best day being 800 m. Ergonomically, this progress can be expressed as 66 m per man day.

Connah failed to triangulate between the radial roads, so the resulting map was badly distorted in places; but it revealed that the walls were a composite of different settlements separated by wide bands of no-man's-lands, which were progressively enclosed in a process of fusion over the centuries. The oral tradition view of three concentric 'walls' was no longer credible; but it persisted amongst Bini historians, many of whom sadly showed no sign of having ever read Connah (archaeologist), Bradbury (ethnographer who, *inter alia*, revised the Benin chronology) or Ryder (historian).

In the late 1960s/early 1970s, Darling discovered that such earthworks lay over a considerably more extensive area and, on the basis of Connah's earthworks having a density of about 1 km of earthwork per 1 km^2, he estimated that they were about 10,000 miles long (Guinness Book of Records, 1974). Having competed in UK orienteering at the national level, he had a somewhat different surveying technique, using an orienteering compass to the nearest 10 degrees and pacing it off so as to stop at a ten-pace interval (usually 20, 30, 40 or 50 paces). Paper folded into 16 fitted under the compass in his left hand and acted as a notebook: a biro was held in the right hand.

These instrumental traverses using co-ordinates derived from compass and pacing, proceeded at a rate of between 4 and 10 km a day. Initially, a local worker helped to clear the undergrowth, but with experience at taking the line of least resistance through the vegetation (alongside or along bank or ditch), this became no longer necessary. In ergonomic terms, therefore, these surveys were 500 to 1000 times more efficient than Connah's surveying teams, even though they were only about 4 to 8 times faster than the two teams per day.

Accuracy was checked by measuring accumulated error using the sine totals of the 10-degree angle sets; and errors were surprisingly low, in the region of 1–3%. Steel tape and prismatic compass surveys along tracks and roads, to pinpoint intersections with the earthworks, as well as the use of Federal Survey maps, aerial photographs and a plan variograph, helped to reduce accumulated error further.

After initial surveys at Ologbo (where the author was teaching) and near Oluku junction, the then Federal Department of Antiquities met expenses for further surveys around Okunmwun, Idogbo, Evbonikhuo, Ugbenu, Uroho and Oka. At the same time the author helped to coach and train with the Midwest State cycling time and he ended up with a medal at the 1973 First All Nigeria Sports Festival. As a result, he was awarded a Nigerian State Scholarship to study what was known of these earthworks in UK-based literature, before returning to undertake full-time surveys of them. The Federal Department of Antiquities met the expenses, the State Board of Education provided a salary for an Education Officer on Special Duty, and the Military Governor's Office in Benin provided housing and transport.

Simultaneously serving these three masters, the survey work over the next five months was on course to complete surveys of the whole 6,500 square km earthwork cluster, within the five years allocated for this project. Very soon, it was clear that there were different zones of earthwork density. Numerous small enclosures with several additional loops and narrow *cordons sanitaires* lay in a core to the north-east and east of Benin. Around this core were peripheries of large enclosures with few additions and broad bands of no-man's land. Later, these peripheral zones were recognized as migratory wave fronts, into which migrants were attracted. To the south-west lay the Benin wave front, which from Connah's dates and one from Ohovbe, could be dated to the 12th century or 13th century. To the south was the 14th century Ugha Kingdom wave front. To the north-east lay the mid 15th century Ishan wave front. The earthworks appeared to depict some of the complexities of the wider state-formation process that gave rise to the Benin and Ishan kingdoms.

After two months work, the author attended a conference of Nigeria's archaeologists and with some shock realized that a) he had already done more fieldwork in those two months than all the others had done over the last year b) there was little genuine interest in archaeology or this work—quite understandably, nationalistic politics and suspicion ruled the day. However, all was not lost: the contact encouraged Fred Anozie to request surveys of the Okpe Igala in Anambra State; it resulted in Robert Soper asking the author to join in surveys of the walls of Old Oyo; and a subsequent historical conference brought him into contact with Ade Obayemi, whose real interest was most encouraging.

Five months into the Benin work came the military coup that toppled the Gowon regime. Everyone in receipt of Government funding became the subject of investigation; and the Federal Department of Antiquities was too frightened to override the refusal of a local curator (who was subsequently sacked for corruption) to pay expenses due; and N1,600 of these were met by the Military Governor's Office (the rate of exchange was then close to N1 = £1). With no expenses, and the growing clarity that the new regime wanted little connection with anything approved by the previous regime, the author hung on. Minimizing expenditure to that which could be met from his salary, he switched from surveying the earthworks to gathering the oral traditions, sherds and cultural landscapes associated with them.

Progressively, the field vehicle was requisitioned, surveyors came to inspect the house for the next users, and other pressure was applied. However, the author carried on working until his contract expired in 1976. He then decided to write up the results at the Centre of West African Studies at the University of Birmingham, UK. Within a term, his degree was retrospectively upgraded from an MA to a PhD; so he returned to Nigeria to obtain samples for radiocarbon dating and to make a 160 km-long pottery sherd transect from Benin to Ukpilla, using the recently constructed 132kV (and the 33kV trans Ishan) transmission lines.

The datings suggested a 700–1450 A.D. construction period: seriation analyzes of the sherds collected showed a movement from north to south, consonant with ramal analyzes of the linguistic data.However, a change in University policy meant that charcoal samples could no longer be measured for free; so only a few were dated (using personal savings)—not enough to demonstrate fully the chronological relationship between the core and the periphery of the earthwork cluster.

This means that alternative explanations for the earthwork zonations, e.g., the establishment of small settlements in Isi (in the core) are still viable, especially if one is inclined to explain everything in terms of the Benin dynasty. The earthwork pattern of *cordons sanitaires* (narrow strips of no-man's-land between opposing territories in the core zone (bank, ditch, level strip, ditch, bank) appears to be imitated by bifossate earthworks in the periphery (bank, ditch, level strip, ditch bank), although some are more defensively rational (bank, ditch, bank, ditch). Also, oral traditions link in well to the large earthwork enclosures on the periphery (Okhunwun, Iwu, Utekon. Idogbo, Oka) but often have no link whatsoever with the small primary enclosures of the core zone. Indeed, many of the oldest settlements in the core zone cannot recollect any connection with the high density (7 km earthworks per square km) earthworks all around them. Both these observations of the typology and oral traditions point to a core to periphery sequence, predating the Benin dynasty.

The Benin Oba's *avbiogbe* surveyors from Ife demarcated with trees, not with earthworks; and many of Benin's provincial *Enogie* officials have residences outside the primary earthwork enclosures. Other major leaders, such as the Osa, have villages occupying the broad bands of no-man's-land, not primary enclosures. However, the Iya n'Akpan—the second earthwork enclosure around the northern, western and south-western part of the City wall—is occupied by the Uzama villages on which the dynasty depended; so no simplistic interpretation is secure.

The spiritual significance of the earthworks as the boundary between the real physical world (*agbon*) and the spirit world (*erinbhin*), indicates a considerable passage of time since their construction. An old practice, now forgotten and in disuse, echoes an earlier era of exogamy, whereby men stayed put within their village territory, whilst the women could trade (and intermarry) with neighbours; and the women used to sing out as they crossed the boundary earthworks so as not to be mistaken for men, who might be regarded as a war party.

These earthworks, therefore, do more than demarcate territory. They were probably first dug around settlements and their farmlands as barriers against the nocturnal raids of the forest elephant, over a thousand years ago. As more land was required, these linear earth boundaries became useful demarcators of territory and included the vital social function of inter-marriage injunctions within small settlements. As younger sons had no claim to home territory, it seems likely that they were the major component in short-distance migrations from the core to the periphery; and these migratory wave fronts became growth areas attracting in migrants from all around.

In 1993, the author tried to organize work to win Nigeria's first UNESCO World Heritage Site for the Benin earthworks, along with the 1,000-year-old, 160 km-long, 20 m-high Sungbo's Eredo kingdom boundary rampart, around the Ijebu heartland. With the collaboration of the *National Commission for Museums and Monuments*, the authors conducted extra surveys at Udo and Ekhor, helped the Principal Superintendent of Monuments to draw up local conservation agreements, and in 1996 took the opportunity to open up British Foreign Office funding for Benin's Centenary Committee, to undertake a clean-up of the main Benin City Wall, and ghost-wrote the nomination document. Sadly, the political suspicions leading to the downfall of Benin a century previously were repeated in respect of the Foreign Office funding and the conservation agreements waiting to be ratified by the Oba. Without, inter alia, any evidence of action and with the non-signing of those agreements, Benin lost its opportunity of becoming Nigeria's first UNESCO World Heritage Site; and its 'World Heritage' archway to the bronzecasters' street is a sad echo of what might have been.

Nonetheless, the Benin earthworks were the author's introduction to archaeology in Nigeria; and the negative politics of Benin merely served to let him cast his net more widely throughout Nigeria, leading to further discoveries of its incredible and fascinating archaeology. The destruction of Nigeria's vulnerable visible archeology was of considerable concern, particularly since virtually no one else was surveying these features. By conducting fieldwork adventure holidays, he brought in UK archaeology students, who then worked with Nigerian colleagues.

Homework inspecting old map, aerial photographs and books, provided a wealth of over 5,000 sites worth examining; and over the last few years much of Nigeria's northern and middlebelt archaeology has begun to come to light. Major Yoruba kingdom boundaries have been mapped at Ijebu, Old Owu and Ilesha, with extensive city walls also surveyed at Olle, Otefon, Kabba, Ikija, Abeokuta and elsewhere.

These large features express the priorities of past ages: they were some of the first to be constructed, they took up a large labour force and they required considerable organization and planning. By surveying their features and recording their associated rich cultural landscapes, Nigeria's earthworks are serving to re-interpret or confirm much of Nigeria's nearly forgotten history and prehistory in terms of its past priorities.

REFERENCES

Barth, H. (1857). *Travels and discoveries in North and Central Africa.* London: Ward Locke & Co. (1890).

Berns, M. C. (1993). Art, history and gender: Women and clay in West Africa. *The African Archaeological Review, 11*, 129–148. (CUP.)

Connah, G. E. C. (1985). Agricultural intensification and sedentism in the *firki* of NE Nigeria. In S. Farrington (Ed.), *Prehistoric intensive agriculture in the tropics, part ii* (pp. 765–785). Oxford: BAR International Series 232.

Darling, P. J. (1984). Report on archaeological activities at Bayero University, Kano. *Zaria Archaeological Papers, VI*, 24–27.

Darling, P. J. (1986). Fieldwork surveys in and around Kano State, Nigeria. *Nyame Akuma, 27*, 39–41.

Darling, P. J. (1987a). *The splendours and miseries of technical change in agriculture.* Winegarten Essay Prize, National Farmers' Union/Wye College, Ashford, Wye.

Darling, P. J. (1989a). Archaeology and the dating of historical events in Kano. In B. M. Barkindo (Ed.), *Kano and some of her neighbours*. Kano: Department of History, Bayero University, Ahmadu Bello University Press.

Darling, P. J. (1989b). How cattle, iron, sorghum and irrigation influenced social and agricultural development in Hausaland. *Nigerian Field, 54*, 11–18.

Darling, P. J. (2004). Migrants, millenialists and mayhem: Kari-Kari, Ningi, Gwari, Kebbi, Kwatarkwashi and Zuru 'enclaves' in northern Nigeria. In L. Smith, P. Rose, & S. Wahida (Eds.), *Fifty years in the archaeology of Africa. Themes in archaeology and practice. Papers in honour of John Alexander* (Azania Special volume XXXIX). Nairobi: BIEA.

Darling, P. J. (2009). *The visible archaeology of Hausaland: Sherds, stones, slag, shrines, words, walls and baobab tree dating*. Powerpoint presentation and paper for Conference on Hausa identity, UEA & Liverpool.

Eghaverba, J. (1968). *A short history of Benin*. Ibadan: Ibadan University Press.

Fagg, A. (1972a). Pottery from the rop rock shelter excavations of 1944 and 1964. *West African Journal of Archaeology, 2*, 20–38.

Fagg, A. (1972b). A preliminary report on an occupation site in the Nok valley, Nigeria. *West African Journal of Archaeology, 2*, 75–79.

Last, M. (1993). History as religion: De-constructing the Magians ("Maguzawa") of Nigerian Hausaland. In J.-P. Chrétien (Ed.), *L'invention religieuse en Afrique: historie et relgion en Afrique noire.* Paris: Karthala.

Madauchi, I., Isa, Y., & Daura, B. (1968). *Hausa customs.* Zaria: Northern Nigerian Publishing Company.

Magnavita, C., & Magnavita, S. (2001). New evidence of proto-urban settlements in the Lake Chad area. *Nyame Akuma, 55*, 46–50.

Magnavita, C., & Magnavita, S. (2002). Recent finds of domesticated *Sorghum bicolour* in the Lake Chad region. *Nyame Akuma, 57*, 14–20.

McIntosh, R. (1999). Africa's storied past. *Archaeological Institute of America, 52*(3).

Meek, C. K. (1925). *The northern tribes of Nigeria*. Oxford: Oxford University Press.

Mortimore, M., & Wilson, J. (1965). *Land and people in the Kano close-settled zone: A survey of some aspects of rural economy in the Ungogo District, Kano Province* (Occasional Paper 1). Zaria: Department of Geography, Ahmadu Bello University.

Mortimore, M. (1989). *Adapting to drought: Farmers, famines & desertification in West Africa.* Cambridge : Cambridge University Press.

Patton, A. Jr. (1975). *The Ningi chiefdom and the African frontier: Mountaineers and resistance to the Sokoto caliphate, ca. 1800–1908* (Unpublished Ph.D. dissertation). University of Wisconsin, Madison, WI.

Shaw, T. (1978). *The archaeology of Nigeria.* London: Thames & Hudson.

DAVID A. AREMU

11. ENCLOSURES OF THE OLD OYO EMPIRE, NIGERIA[1]

INTRODUCTION

According to the oral tradition of Oyo people, Koso was a former capital city of the Oyo Empire. There are three earlier capitals near the Niger River. The people moved to Koso for security reasons and settled on Koso Hill and below the Bara Mountain. They later moved further South to Oyo Ile, then to Ipapo Ile, Igboho, and back to Oyo Ile before they finally settled at the present Oyo, 52 km northeast of Ibadan (Abimbola, 1964; Agbaje Williams, 1989; Aremu, 1997; Babayemi, 1980; Morton-Williams, 1967). Bara is about 3 kilometers northwest of Koso. It was a settlement site where late Alaafins were buried. Extending Oyo Ile to Koso and Bara would provide some of the rich historical, archaeological and cultural materials of the ancient Oyo.

HISTORICAL SIGNIFICANCE OF SANGO AND OYA IN KOSO

The Yoruba called the Niger River "Odo Oya" after Oya, the wife of Sango. The oral history indicated that any time Sango was traveling to the north he used to meet this beautiful woman named Oya at the bank of the Niger. After falling in love with her, Sango started showering her with gifts whenever he traveled to the north. These love overtures eventually led to marriage. After their marriage Sango discovered that Oya had some supernatural powers and this, in conjunction with her beauty, made Sango love Oya more than his other wives. As a result of rancor in Oyo between Gbonka and Timi, Sango, the fourth Alaafin of Oyo, was forced out of his domain and all his wives and people left the town with him. Because of the humiliation, Sango committed suicide and many of his followers went back to Oyo. Oya, his faithful wife, did not go back because this would have been a disgrace had she returned to Oyo. She decided to go very far from Oyo by following the forest until she got to a certain area now called Ira, southeast of Oyo, in Oyun Local Government Area of Kwara State. There is an Oyo shrine at Ira, located south of the town. The Ira people claim that their ancestor came from Oyo.

Sango and Oya have been deified and have become one of the most famous Orisas in Yorubaland. These historical events have led to a common saying in Oyo that:

"Oya wole Nira
Sango wole ni Koso."

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Interpretation:

Oya entered the ground at Ira (i.e., died)
Sango entered the ground at Koso (i.e., died)

Our archaeological reconnaissance was carried out at Koso. Among the present Oyo, Igbeti, Kosa, Bani and other neighboring towns there is the fear that nobody could climb Koso Hill because it was where they claimed that Sango died. They believed that his spirit might still be around and might harm anybody that got to the site. It was considered as part of the objectives of this research to find out where Sango died at Koso We climbed the hill to where it is claimed that Sango died. The place is a big rock outcrop with another on top of it forming a 'T' shape. Contrary to people's speculations, beneath the site is a flat rock outcrop on which one might spread farm products. There are potsherds scattered around the area and a mud wall protecting the northern part of a rock shelter, south of the flat rock outcrop. Sango might have hung himself and died but it might not be on the 'T' shaped rock outcrop.

They claimed he died on Koso Hill and that Koso site was named after Sango's death. His favorites disputed how he died. Some said "Oba so" (the king hung), while others said "Oba Koso" meaning "The king did not hang." Thus, the name 'Koso' abbreviated from 'Oba Koso' emerged. This implies that the site might have been called another name before Koso. None of our informants could clarify this assumption.

Sango as Alaafin of Oyo built and left behind a virile capital city at Koso. He might have enjoined the cooperation of his subjects as their king, which must have helped to achieve the building of the various defense walls at the site. It is possible that more than one Oba might have reigned at Koso apart from Sango. The contributions of all such rulers might have led to the development of Koso before it was abandoned. After the death of Sango and Oya, both were deified and are still worshipped. In life, both exercised political power and influence over the people, and in death they were deified and worshipped as *Orisas*. It is a way of honoring past heroes by preserving what they left behind.

RECONNAISSANCE OF KOSO

Igbeti is one of Old Oyo National Park's Patrol Post and it is about 40 km to Oyo Ile. A new and more accessible Patrol Post is built at Awodi, 10 km to Oyo Ile, for administrative convenience and to prevent poaching activities. Iron slag is scattered in the bush opposite the Patrol Post, which is evidence of iron smelting in the area in the past. There are Fulani farming settlements between Oyo Ile, Koso and Bara. These are Budo Are (nearest to Oyo Ile at the northeast), Budo Audu (nearest to Koso from the west), Onigbangba (closest to Bara) and Elenre about 4 km northwest of Koso. The Fulani farmed and grazed their cattle in this area. The nearness of these settlements to Oyo Ile Park was causing a poaching problem to the park, with rangers making several arrests and prosecuting many. The poaching problem reduced a little

after the park management used dialogue, an enlightenment campaign and adopted friendly attitudes toward the surrounding population.

Vegetation

The vegetation in the area contains remnants of the rainforest. The present day vegetation is the result of land cultivation, cattle grazing and severe annual bush-burning. The southern Guinea savannah has a similar general appearance of derived savannah. The area contains a whole range of vegetation types, including a riparian forest, a concentration of herb trees and other woody plants and grasses. Some of the trees and shrubs have twisted and gnarled trunks as a result of frequent fires that have checked their growth. The bark of most species is very thick, usually more than 1cm, and this probably accounts for their tolerance of fire. The trees include Afzelia africana (mahogany bean), Elaeis guineensis (oil palm), Butyrospermum paradoxium (shea butter) with deep fissuring, Daniellia oliveri African (copaiba balsam), Parkia clappertoniana (African locust bean) and Vitex doniana (black plum). The farmers cultivate yams (Dioscorea spp.), cassava (Manihot esculenta), maize (Zea Mays), guinea corn, and vegetables such as okra (Abelmoschus esculentus).

The mammalian fauna found in this area include baboon, (Papio anubis), the red monkey (Erythrocebus patas), crawshay's hare (Lepus crawshayi) and giant rats (Cricetomys gambianus). Large herbivores include waterbucks (Kobus defassa), Kobs (Kobus kob), bushbucks (Tragelaphus scriptus), roan antelopes (Hippotragus equinus), and warthogs (Phacochoerus aethiopicus). Carnivores include spotted hyenas (Crocus crocuta), wild dogs (Lycaon pictus) and lions (Panthera leo).

Koso Hill

Koso is a hilltop settlement which extends down the hill to the west and the south. The hill is separated to the north and south with a gap which is occupied by a defense wall. There is evidence of settlement on the hills at the two sides. The people claimed that Sango died in the north. In this area are two rock shelters—one with mud walls that served as partitions in the rock shelter, and inside the other, a piece of rock which might have been used as a stool. Other cultural materials in the area include grinding stones, house foundations, rock hollows and potsherds. In the southern hill, the house remains are more pronounced with partitioned room walls still discernible. Most of the houses were built into rocks serving as side walls. The rooms are 4m and 3m long and wide, respectively, and are rectangular in shape. There are many protruding granite rock outcrops which might have attracted people to this area.

Koso Defense Walls

Koso settlement is surrounded by three walls. The innermost wall was investigated in March 1999. From the survey of the wall to the west, the outermost wall is 3.6 km.

The outermost wall continued northwards towards Bara, while the wall to the south might have extended to Oyo Ile (Olatuboson, 1999: Pers. Comm.). The innermost wall in the North is 3.8 km, West 4.3 km., East 4.4 km, and South 4 km. The walls were in three categories of deterioration at the time of the fieldwork. These are: (1) standing mud walls above 1m to 7m high (2) mud walls of 0 to 1m high, and (3) heaps of raised ground indicating the wall path. These are discussed below.

Standing Mud Walls

These are more pronounced in the northeast where we have Koso Hill, than in any of the other sides of the site. The height ranges from 5.1m to 7m and 1.6m in thickness. They range from nine to thirteen courses on top of each other. The mud walls have attractive intrusions of potsherds, quartz, quartzite and granite rock. Two meters from the ground floor are holes 10cm in diameter, created through the wall at 1m intervals. Ajayi and Smith (1971) were of the opinion that where such occurred on the walls of new Oyo, Osogbo, Ikirun and Ijaye, guns could be fired to the enemy through holes. While that might be possible during the period of gun use (A.D 15th century and above), Koso might predate such a period, and the holes might not be used primarily for firing guns at enemies but to view opponents from outside as a security measure.

Mud Walls

Walls from ground level to 1m high occurred on every side of the settlement. They indicate the last stage of destruction of the walls wherever they occurred. They exhibit the same character of thickness as potsherds, quartz and quartzite intrusions.

Mounds

Raised ground or mounds were observed along the wall path where the walls had been destroyed. The collapsed wall might have created humus soil along the wall path on the raised ground. The trees grew in sequence along the path as if planted deliberately. Porcupines dwelt inside the raised ground. Spines of porcupines killed by hunters were found during the survey along the northern and western walls. Digging of the walls by hunters, to kill animals, endangered the preservation of Koso Wall.

The standing mud walls at Koso constitute a rare cultural heritage that should be preserved. They cover a length of about 150m stretching east-west. There is no occurrence of such standing wall monuments in any part of southwestern Nigeria. The reconstruction and preservation of walls on Koso Hill to the south should be carried out. These are about 180m south of the standing walls. The cultural features on Koso Hill to the north would add to the many attractions at the site. Apart from

mud walls, in a few places in the west there are other cultural materials along the wall path and in the settlement, such as potsherds, ash mounds, grinding stones, rock hollows, rock shelters, some flake tools, quartz, quartzite and laterites.

IMPORTANCE OF KOSO DEFENSE WALLS

The settlement enclosed by the walls is more important than the actual earthworks. In a general sense, any fortification serves as an indication of the size, wealth and importance of the town or city it enclosed. It provided security for the lives of those within the wall; Koso is no longer inhabited. The architectural building of the walls, its size and boundary, the settlement remains, and the cultural materials at the site are sources of information about the lives of the people who lived in the area. The walls serve as people's cultural heritage which, if well-preserved, can provide more information about the past and the future. The walling city might have enclosed people of the same historical and cultural background. Oral traditions suggest that the former inhabitants of Koso were Yoruba of the Old Oyo Empire.

Koso might have been an important commercial centre. One of the important reasons for the construction of walls and embankments around settlements was to protect commercial activities. As a result of a flourishing trade, towns were at war with their neighbours in an attempt to gain control of trade routes and commercial centres. By A.D. 1000 to 1500, Kano and her neighbour Katsina were the strongest commercial centres of Hausaland and their peace was constantly disturbed. They were forced to construct a civic defense to protect the operation of both regional and inter-regional trade and commerce, which constituted the essential life blood of the city.

In history it is recorded that Oyo Ile, Kano, Zaria, Ife, Benin and Ijebu Ode were, one time or the other, centres of commercial activities (Adesina, 1979). Oyo Ile's commercial position may have started at Koso before the people moved to Oyo Ile. Towns enclosed by walls and embankments usually served as centres of political power. This was true of Koso and Oyo Ile, which were capital cities of the Oyo Empire in succession. In order to defend the city against external aggression, walls and embankments were built. The construction of walls and embankments of Zaria, Kano, Sokoto and Katsina brought peace to the towns thereafter. The walls were built as a means of repelling possible military attacks. The walls were of special importance in their functions as political and military enclosure. People who lived in settlements near the walls were allowed into the city during war.

It was in the process of establishing kingdoms and providing stable commercial centres with maximum security that defense was constantly extended and maintained. The walls and embankment of Koso have helped to throw more light on the history of the Oyo Empire. The existence of the wall has given us a concrete location and the physical extent of this capital city of the Oyo Empire. Connah's excavation of the innermost wall of Benin near Ogba road gave an insight to the practice of iron smelting, and the period it started. It has also been possible

to date Oyo Ile through the pottery type incorporated in the walls. Koso walls have become an irresistible tourist attraction because of their height, thickness, architecture and history, important reasons for advocating the preservation of the cultural remains.

PRESERVATION OF KOSO WALLS

Koso walls have been exposed to some dangers leading to the collapse of parts of the wall. Each successive rainy season washed the wall from the top to the foundation level eroding parts of it. Trees that grew near the wall became very big and the branches and roots destroyed parts of the wall. Hunters excavated various parts of the wall while hunting for small games without any regard for the preservation of the wall. The National Commission for Museum and Monuments proposed Old Oyo as one of Nigeria's UNESCO World Heritage sites. In other countries such as Peru, earthen sites or mud walls like the Old Oyo walls account for 10 percent of the UNESCO World Heritage list. A renewed commitment to the conservation of earthen architecture and the promotion of its values is essential for this heritage to be universally recognized as an area of study and of professional practice as suggested by the International Centre for the Study of the Preservation and Restoration of Cultural Property (ICCROM) (Little, 2001).

CONCLUSIONS

Innumerable artifacts of Nigerian cultural heritage have been destroyed due to ignorance on the part of the custodians, the irresponsibility of cultural administrators and unsupportive attitudes by government. Many reports have been made about artifacts of Nigerian cultural heritage which had been allowed to waste away. The beauty of Koso rock outcrops and rock piles and the architectural fascination of the standing mud walls are enough to attract tourists to the area. Preservation of cultural and natural resources is the key to successful tourism in Nigeria. More tourists would be encouraged to visit the site if the cultural and natural relics were better preserved.

NOTE

[1] This chapter is a modified version of a paper initially published in *Africa Update*. Vol. XIV, Issue I (Winter 2007).

REFERENCES

Abimbola, W. (1964). The ruins of Oyo division. *African Notes, 2*(1), 16–19.

Adesina, M. O. (1979). *City walls and embankments in the savanna and forest areas of Nigeria* (B.A. project, Department of Archaeology and Anthropology). University of Ibadan, Nigeria.

Agbaje-Williams, B. (1989). The discovery of Koso, an ancient Oyo settlement. *The Nigerian Field*, *54*, 123–127.

Ajayi, J. F. A., & Smith, R. (1971). *Yoruba warfare in the nineteenth Century*. Ibadan: Ibadan University Press.

Aremu, D. A. (1979). *Preservation of archaeological resources in Old Oyo National Park: A means of promoting cultural heritage and tourism in the park*. Report Submitted to Old Oyo National Park, Nigeria.

Babayemi, S. O. (1980). *The fall and rise of Oyo, C. 1760–1905: A study on the traditional culture of an African polity* (Ph.D. dissertation). University of Birmingham, UK.

Connah, G. (1975). *The archaeology of Benin*. London: Oxford University Press.

Davidson, B. (1965). *Old Africa rediscovered.* London: Oxford University Press.

Little, T. (2000). *The architecture and archaeological site programme in International Centre for the Study of the Preservation and Restoration of Cultural Property (ICCROM) Newsletter,* October, 2001, 27.

Morton-Williams, P. (1967). The Yoruba kingdom of Oyo. In D. Forde & Kabemy (Eds.), *West Africa kingdom in the 19th century*. Oxford: Oxford University Press.

ARIBIDESI USMAN

12. ENCLOSURES OF NORTHERN YORUBALAND, NIGERIA[1]

INTRODUCTION

Fortifications, especially enclosing walls, are common features in large African political centers and have been widely studied (Connah, 1975; Ozanne, 1969; Posnansky, 1969; Soper & Darling, 1980; Amutabi, 2012; Darling, 2016). African city walls consist of enclosures, either single or multiple, that entirely or partially surround habitation. Various materials were employed in their construction. This includes stone, clay or earth with banks and ditches, timber stockades or naturally grown vegetation. The increasing interest in the periphery of large Africa polities has revealed that the walling systems were more widespread than previously thought. Enclosure walls like those in large political centers have been found among small-scale African societies. It appears that the same forces and needs which made construction of enclosures possible at large centers were also at work in the periphery. Archaeological investigations conducted in Northern Yorubaland have resulted in the discovery of pre-19th century fortifications, similar to those associated with large polities of Ife, Benin and Oyo. Northern Yorubaland encompasses the present-day Kwara and Kogi states of Nigeria. The region comprises several ethnic groups, notably the Yoruba, Nupe, Baruba, Ebira, Igala and Kakanda. In the past, Northern Yorubaland was characterized by the movement of peoples, contact with other cultures and confrontations that were sometimes endemic. As a result, social consequences flowed from this.

This chapter is the result of some work carried out in the Igbomina area of Northern Yorubaland. Fortifications have been found at several settlements in the region, but two of these, Gbagede and Iyara, located within the Igbomina area of Northern Yorubaland, are discussed here. The intent of this chapter is twofold. The first is to provide a survey description of the walls, and the second is to explore the functional interpretations of the walls. The study of fortifications in this part of Yorubaland will also provide an understanding of the nature of Old Oyo's northern frontier and the prehistoric social relations in the area, especially between Oyo-Igbomina and the Nupe.

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DESCRIPTION

The Gbagede site is located about 3.2 km northeast of Ajasepo town in Kwara State of Nigeria. The site is situated on relatively flat land bounded to the west by the Osin River which flows to Omupo town, and on the east by river Egui. Iyara is located about 2.2 km northeast of Ajasepo town and about 1 km southeast of Gbagede site. The sites are situated on relatively flat terrain with derived savanna-type vegetation. The small Igbinla River enters the Iyara site from the southeast and flows toward the northwest where it escapes through the wall toward the direction of Gbagede. The first survey of Gbagede and Iyara walls first carried out in 1995, involved taking measurements between points along the wall using tapes, ranging poles and a prismatic compass. The distance between one point and the next is 30 m, except at corners and near gates. Early in 2003 these walls were re-examined using GPS equipment.

Gbagede is a large pre-19th century settlement with an enclosed wall of mud, occupied between 1390 and 1795. From the 2003 survey estimates, the height and width of the walls range between 1 and 3 m high and 4 and 6 m wide. Three main entry gates, probably with sentry, and two or three minor entrances were associated with the Gbagede wall. There are excavated holes or pits placed randomly inside the wall. These pits are in most cases with exposed granites and may have served as water reservoirs for the inhabitants of Gbagede. Inspection of the southern and eastern walls revealed stones and potsherds projecting out of the wall. These may have been incorporated into the wall during construction. The survey of Gbagede indicated a single wall system with a circumference of about 3.4 km, while the site area was estimated at approximately 0.612 km^2. In the case of Iyara, the wall is rampart with two main entrances, with a continuous ditch located outside the wall. The depth of the ditch varied from one section of the wall to another with the deepest about 1.3 m. Such a deep ditch was unique for a rampart. Generally, the wall height ranged between 1.2 m to 2.0 m, while the width was between 4.3 m to 5.5 m. The Iyara enclosure is estimated to be about 2.8 km in circumference. The name Iyara seems to be synonymous with the physical feature, the conspicuous walling system. Iyàrà or Yàrà in Yoruba means trench, or ditch, behind the walls of a town.

SOCIOPOLITICAL RELATIONS

The sociopolitical circumstances which necessitated the construction of enclosed walls in Northern Yorubaland involved the consideration of two forms of social relationships in the region: the Oyo-Igbomina relationship and the Yoruba-Nupe relationship. The rise of Oyo was related to the formation of links with periphery groups. The establishment of such links usually came as a reaction to some external or internal threat which necessitated the demonstration of unity in the area. For Oyo, such a circumstance arose with the Nupe invasion of Oyo-Ile in the 15th century. The expansion of Yoruba (Oyo) was an outgrowth of the formation of alliances between

the Oyo and the Yoruba frontier groups whose thrusts into Northern Yoruba terrain were the most penetrating when the tensions between the Oyo and the Nupe were high. The strategic importance of Igbomina to Oyo in terms of political or military purposes, appear to have constituted an important basis for alliances. Igbomina was a frontier area occupied during a geographical expansion of the Old Oyo in the 16th century, an expansion which furthered the political and military interest of the state. The Igbomina-Yoruba frontier was located near the Nupe ethnic group, who lived both on the right bank of the Niger downstream of Jebba and to the north of the Niger River. The Northern Yoruba society, located between the Nupe and Old Oyo, had the strategic advantage of protecting Oyo's northern frontier.

The Nupe ethnic group earlier divided into several small political formations and later united into a single kingdom (Elphinstone, 1921), north of the River Niger. But there was also a Nupe province, centered on the town of Ogudu, on the right bank of the Niger downstream of Jebba close to the Igbomina. While it may be very difficult to understand the events of this period, it has been suggested that some of the areas in Northern Yorubaland were also inhabited by the Nupe; that they were subsequently dislodged and partially absorbed by successive waves of Yoruba immigrants first from Ile-Ife and then from Oyo-Yoruba speaking areas (Adepegba, 1982). This claim would seem to be supported by the soapstone figures found in Igbomina areas which exhibited both Nupe and Yoruba culture traits (Stevens, 1978). It appears that both cultures (Yoruba and Nupe) may have co-existed until a certain time, probably by the 16th century when the Nupe were displaced by the expansion of Old Oyo (Obayemi, 1976), and inter-group violence with the Nupe began to pose an ever-present threat to the well-being of the people and the survival of Oyo's northern frontier.

FUNCTIONAL INTERPRETATIONS

The study of site enclosures reveals how an architectural feature might have functioned in regard to prehistoric social relations. Here, I will explore the applicability of one of the most commonly applied functional labels, that of defensive, as it relates to Northern Yorubaland. Warfare was a major unpredictable environmental variable in the region. Therefore, there should be a correlation between those elements of the cultural system's environment which are unpredictable and evidence of a society-wide organizational activity to deal with them. A good example of preventive action taken by the people was the construction of fortifications. Thus, important towns, and even some larger villages in Yorubaland, were surrounded by a roughly concentric 'wall' of dumped earth or, less often, by a stockade (Smith, 1973). As well as providing defense in depth, wall and ditches offered protection to an army forming up for attack between the walls.

Oral traditions, dating as far back as the 16th century provide historical evidence of military invasions of the Yoruba by the Nupe. The Nupe influence began to grow in the area when attempts by Old Oyo to build a military outpost in Igbomina failed

to check Nupe incursions (Law, 1977). The Nupe intensified their incursions in Northern Yorubaland in the mid-18th century when the constitutional crisis in Old Oyo began to pre-occupy the aristocracy and reduce Oyo's control in the north. This information includes oral history about wars fought, and the destruction and abandonment of settlements well remembered by elders. The Nupe incursions of the mid-18th century became particularly noticeable during the reign of three Nupe kings: Etsu Jubrilu (1744–1759), Majiya II (1769–1777), and Mu'azu (1779–1795) (Elphinstone, 1921). Although these Nupe military encounters can be described as "smash and grab" operations with little consideration for long-term exploitation, they continued well into the 19th century when the Fulani conquest or rule was superimposed on the north-central Yoruba.

A version of oral tradition suggests that the Iyara site was a war camp founded by one Balogun Adelani, a warrior who migrated from Old Oyo. Wars that were fought by this founder and his successors are given as Erinmope, Adamu, Adunbi, and Agannigan (where men perforated their ears). It is not known when these wars were fought, though some of them appear to refer to the Yoruba civil wars of the early 19th century following the fall of the Oyo Empire. The second version of oral tradition suggests that the site was originally inhabited by the Nupe, and abandoned when the Oyo immigrants arrived in the area. However, there is no excavation material yet to confirm or dispute these assertions.

Further support for the defense interpretation of the enclosed wall is provided by excavated iron arrowheads from some Igbomina sites, which may have been utilized in war (Usman, 2003). Oral tradition in Northern Yorubaland refers to the use of bows and arrows by the Borgu, nearby neighbors of the Oyo, in the time of Alafin Ofinran, who probably reigned at Oyo around the middle of the 16th century (Smith, 1967). The excavated iron arrowheads from Igbomina have been dated to between the 15th and16th centuries AD, and appear to suggest that the weapons must almost certainly have been used by the Yoruba-speaking people in the area by the 16th century.

In addition, walls may act as spatial demarcation, social regulation, as well as for privacy of the political elites (Adler, 1990; Kane, 1989; Ozanne, 1969; Tringham, 1972, p. 470). In describing Ife walls, for example, Ozanne (1969, p. 32) claimed that, "the communities … must have had a more elaborate social structure than that of autochthonous hamlets of early life. The fact of building a wall indicated a single though probably segmented, polity, in which relations must have been carefully ordered." By demarcating a group's "place" in the environment, a boundary becomes a symbol of the social and political group (Wilson, 1988, p. 60) and may function to reinforce its identity. The fact that residential groups chose to demarcate their settlements with walls implies that the space and its contents were highly valued (Tringham, 1972, p. 470). Some local elites in Northern Yorubaland may have taken advantage of their relation with Oyo to replicate the walling culture of the large polity on the frontier. The character of the Gbagede wall may be related to the sociopolitical importance of the settlement as a 'capital' or head town in the area

where the king, Olupo, resided. The Gbagede and Iyara walls may have political connotations, such as the presence of a highly valued political institution, as an enhancement of privacy and prestige, while signaling the existence of a high degree of political and social cohesion. Whatever the situation in Northern Yorubaland, the walling system, like in the large African political centers, were major projects that would have required discipline and planning, as well as leaders with the ability to marshal the labor and provide food and resources for the construction.

CONCLUSION

The geopolitical situation in Northern Yorubaland, the encircling nature of walls, ditches, settlement abandonment and excavated 'weapons' of war have helped in suggesting a climate of hostility. It is possible that warfare, exemplified by the enclosure systems, suggests the collapse of a system of balanced but competing Yoruba and Nupe polities. However, this factor must be understood in relation to other factors. The Igbomina may have constructed enclosed walls and evolved towards increased 'centralized' control and 'hierarchy' in reaction to the Nupe on its borders. The walls were part of the regional socio-political and economic change that occurred in Yorubaland and elsewhere in West Africa from the 15th century.

NOTE

[1] This chapter is a modified, updated version of a paper initially published in *Africa Update*. Vol. XIV, Issue I (Winter 2007).

REFERENCES

Adepegba, C. (1982). Ife Art: An enquiry into the surface patterns and the continuity of art tradition among the Northern Yoruba. *West African Journal of Archaeology, 12*, 95–109.

Adler, M. A. (1990). *Communities of soil and stone: An archaeological investigation of population aggregation among the Verde region Anasazi, A.D. 900–1300* (Ph.D dissertation). University of Michigan, Ann Arbor, MI.

Connah, G. (1975). *The archaeology of Benin*. London: Oxford University Press.

Darling, P. (2016). Nigerian walls and earthworks. In G. Emeagwali & E. Shizha (Eds.), *African indigenous knowledge and the sciences: Journeys into the past and present* (Chapter 10). Rotterdam, The Netherlands: Sense Publishers.

Elphinstone, K. V. (1921). *Gazetteer of Ilorin Province*. London: Frank Cass.

Falola, T. (2011). *Landscape, environment and technology in colonial and post-colonial Africa.* New York, NY: Routledge.

Falola,T., & Amutabi, M. (Eds.). (2012). *Perspectives on African environment, science and technology*. Trenton, NJ: AWP.

Kane, A. A. (1989). Did the sheep look up? Sociopolitical complexity in ninth century Dolores society. In S. Upham, K. G. Lightfoot, & R. A. Jewett (Eds.), *The sociopolitical structure of prehistoric southwestern societies* (pp. 307–361). Boulder, CO: Westview Press.

Law, R. (1977). *The Oyo Empire c.1600–c.1836*. Oxford: Clarendon Press.

Obayemi, A. (1976). The Yoruba and Edo-speaking peoples and their neighbors before 1600 AD. In J. F. A. Ajayi & M. Crowder (Eds.), *History of West Africa* 1 (2nd ed., pp. 255–322). Ibadan, Nigeria: Longman.

Ozanne, P. (1969). A new archaeological survey of Ife. *Odu New Series, 1*, 28–45.
Posnansky, M. (1969). Bigo bya Mugenyi. *Uganda Journal*, *33*(2), 125–150.
Smith, R. (1967). Yoruba armament. *Journal of African History, VIII*(1), 87–106.
Soper, R. C., & Patrick, D. (1980). The walls of old Oyo. *West African Journal of Archaeology, 10*, 61–81.
Stevens, P., Jr. (1978). *The stone images of Esie*, *Nigeria.* New York, NY: Africana Publishing.
Tringham, R. (1972). Territorial demarcation of prehistoric settlements. In P. J. Ucko, R. Tringham, & G. W. Dimbleby (Eds.), *Man, settlement, and urbanism* (pp. 463–475). London: Duckworth.
Usman, A. (2003). The Ethnohistory and archaeology of warfare in northern Yoruba. *Journal of African Archaeology*, *1*(2), 201–214.
Wilson, P. J. (1988). *The domestication of the human species.* New Haven, CT: Yale University Press.

PART 4

MEDICINE

GLORIA EMEAGWALI

13. AFRICAN TRADITIONAL MEDICINE REVISITED

In this chapter we reflect on the basic assumptions, diagnostic procedures and preventive and curative medicinal techniques of African Traditional Medicine (ATM). In the course of discussion we assess some of the frequently prescribed herbs, with a focus on recent phytochemical reports.

DEFINITION OF AFRICAN TRADITIONAL MEDICINE (ATM)

African Traditional Medicine (ATM) consists of an accumulated body of knowledge about the treatment of disease and causative models for explaining disease. It is also true to say that traditional medicine refers to "those practices and knowledge, defined by culture, beliefs and environment before the arrival of conventional medicine," as claimed by Guantai and Chabale (2012), but, unlike the latter, we recognize that traditional medicine continues to be vibrant at the present time, in many parts of Africa and elsewhere. In many cases it is the preferred system of health care for a multitude of reasons—including the perception by patients as well as some scholars, that it is more effective in curing certain ailments than conventional medicine (Guantai & Chibale, 2012, p. 102). ATM has not been static over the ages, and has had regional variations, and successes as well as failures. Even so, a core of recognizable propositions and assumptions prevails. In this discourse we focus on some of the basic concepts and core areas of practice that, broadly speaking, seem to be applicable and operational in various parts of Africa.

In ATM, pathology and illness are often accounted for in terms of both supernatural-centered propositions, and naturalistic, empirical ones (Waite, 1992, p. 12). Within this accumulated system of ideas, are diagnostic techniques and procedures that may blend personalistic, supernatural and naturalistic accounts (Abdalla, 1997, p. 117). There is some common ground with respect to ATM and mainstream medicine. Understanding nature and its environs is a goal shared by the two systems. The associated schools of thought, methodologies and approaches involve conjectures, generalizations and hypotheses. Some level of cautious forecasting and prediction is associated with the two systems, and they both build on previous knowledge, in a cumulative fashion. In the case of ATM, apprentices undergo years of training and may have had generations of ancestors in the profession. ATM also involves trial-and-error experimentation and empirical activities. But ATM is essentially people-centered and communitarian in terms of its modus operandi. There are also major

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differences between them. Endogenous and indigenous African medical traditions view the mind and the body as a complex interconnected whole, hence the very pronounced spiritual and metaphysical dimensions in some practices (Some, 1999, p. 23). The traditional practitioner may view ailments as the result of supernatural and psychic interference and disharmony (Sofowora, 1984). The task of the western-trained doctor is to repair the constituent parts of a machine that malfunctioned for conventional practitioners. For traditional practitioners, however, such repairs might merit appeasement of spiritual entities in addition to medical intervention. ATM seems to have incorporated that tradition of dualism that some may define as wholistic (holistic), in that it embodies both mind and spirituality.

Intervention involves some of the standard, curative, medicinal techniques discussed in the course of this chapter. In contrast to the use of synthetic pharmaceutical products in mainstream medicine, ancient northeast Africans inclusive of Egyptians, Nubians and Aksumites, also engaged in the intensive use of herbal medicaments such as water lilies, pomegranates, poppy seeds, sycamore leaves, frankincense, myrrh and others, in intervention (Allen, 2005; Pankhurst, 1990; Fisher et al., 2012; Finch, 1990). To a large extent ATM is a continuation of this tradition.

In ATM, natural products generally reign supreme, although not exclusively so. In the Ethiopian case, we note that historically, products such as honey, fat and butter were also used (Pankhurst, 1990, p. 114). Several types of beetles were considered useful in the treatment of rabies (Pankhurst, 1990, p. 115). Abdalla makes a similar reference to the use of animal products in Northern Nigeria (1997).

DIAGNOSTIC PROCEDURE

For the ATM practitioner, diagnosis of ailments involves a distinct methodology. First of all there is the physical observation of the patient, with close attention to the relevant parts of the body. Family members may be questioned and a case history constructed. In some cases there is the clinical examination of body temperature and the observation of urine. Divination, water gazing and sand divination may also accompany these measures, depending on the nature of the patient and the associated illness (Abdalla, 1997). This sets the stage for intervention through enemas, suppositories, infusions, elixirs or pills. Regional differences and modifications have been observed but some core principles seem to cut across time and space.

PREVENTIVE AND CURATIVE ATM TECHNIQUES

A wide range of techniques emerged in various regions of the continent inclusive of hydrotherapy, heat therapy and bone setting or orthopedics. One of the common interventions involved spinal manipulation, and some areas became renowned for specialization in the cure of particular ailments, as opposed to others. For example, in Northern Nigeria until recently, the town of Funtua attracted patients undergoing various forms of “bone setting” or orthopedic care. Patients felt that they were less

likely to undergo amputation under the care of the traditional practitioners than in the conventional setting where amputations were common. Inoculation has also been a known procedure. Pankhurst observed that fumigation and quarantine were methods utilized in the case of Ethiopia (Pankhurst, 1990). Steam inhalation of essential oils as well as the use of hot baths, saunas and the application of "hot cloth" treatment have been identified as important aspects of traditional medical methodology. Surgical procedures such as the incision of identification marks, various forms of scarification and circumcision, the removal of inflamed tonsils, perforation of the ear lobe, and incision of abscesses were integrated into ATM practice. There have been records of childbirth involving the removal of the fetus by cutting through the walls of the abdomen and uterus. Pankhurt points to an incredible operation in which a patient operated on himself, and sewed back the wound (Pankhurst, 1990, p. 117). He also points to cupping, inoculation, and, for treating inflammation of the lungs, counter-irritation, in the Ethiopian case—with reference to the 19th century. For traditional practitioners, success has been defined by the progress made in these various interventions, and appeal to the psychic and metaphysical world was often integrated into the activities.

AGENTS AND AGENCIES IN HEALTH CARE

Complicated networks of specialists emerged in the ATM health sector. Some agencies were specialized in launching psychic activity and providing channels to communicate with ancestral spirits but these were often distinct from the herbalists (Adodo, 2013). Itinerant pharmacists who moved around from one village to the next coexisted with sedentary pharmacists lodged in the marketplace or a commercial area. Midwives attended to birth and there were specialists in cataract removal, removal of tonsils, orthopedics and so on. At the core of the medicinal enterprise, however, were the herbalists and experts concerned with the efficacy of identified plants. In the section that follows we shall identify some of their assumptions, and then examine some contemporary phytochemical reports and their evaluations of some frequently used herbal medicaments.

ASSUMPTIONS AND USAGE

The idea that leaves, roots and bark should be best gathered at midday, midnight and late evening respectively, when they were most potent, is a recurrent claim by practitioners (Adodo, 2013, p. 26). There is also a distinction between dry leaves and green ones, and young leaves and shoots, for usage in medicaments, in traditional medical methodology. It is believed that plants emit radiation and energy patterns that only psychics could detect (Sofowora, 1982).

Medicinal plants have been used extensively as anesthetics in some of the surgical interventions mentioned, and as antibiotics in treating disease. They have been used as antidotes against snake poisons, and anthelmintics against worm

infestation. Fevers have been controlled by analgesics derived from plants, and herbal preparations have been used in gastro-intestinal care. Plant remedies have been documented extensively in the treatment of diabetes and hypertension.

CHALLENGES FROM "MAINSTREAM" SCIENCE

Let us focus on some of the complaints that have been levied against traditional practitioners, and evaluate the merit of such complaints. The first complaint about ATM from researchers in the field is an alleged *secrecy* on the part of practitioners of ATM, and a perceived reluctance to divulge fully the secrets of their trade. Related to this complaint is the view that the precise composition of the medicaments prescribed by traditional medical practitioners is often kept from public view, public scrutiny and open evaluation. A second complaint is that the practitioners fail to standardize medicinal preparations and offer varying arbitrary dosages to their patients. Thirdly, traditional practitioners are accused of being unable to understand and act with precision against micro-organisms, in the absence of the current generation of spectrum microscopes and hi-tech medical equipment. Some of these complaints have validity. We should note, however, that in the mainstream medical complex, a sophisticated legal system involving patents, copyright and intellectual proprietary and property rights, protects pharmaceutical, pharmacological and medicinal data, and the scientists that produce them. ATM practitioners, by refusing to divulge the secrets and intricate dimensions of their practice, also seek, and undoubtedly deserve, protection of their intellectual property rights. In terms of the second criticism, practitioners, for their part, argue that the one-size-fits-all prescriptions meted out by "mainstream" medical practitioners do not pay adequate attention to the variations in weight, size and body mass of patients. The argue that they, the ATM practitioners, take these variations into account.

There is great truth in the third criticism. The strength of "mainstream" medicine is its ability to identify micro-organisms, their shape, and their modes of infection and invasion of the body, the toxins they produce and the symptoms that they induce. A wide array of hi-tech computerized diagnostic gadgets, instruments and assists noble and gargantuan enterprise. Traditional medical practitioners generally do not use these technologies. We see this clearly in the case of Ebola viral hemorrhagic fever or Ebola Virus Disease (EVD). Thanks to researchers such as Saishankar Muradi et al. (2014), we are aware of some of the following epidemiological data about EVD. Muradi et al. succinctly observe the following:

> STRUCTURE – Single-stranded, linear, non-segmented – Filamentous – shape of "U" or "6" – Coiled, toroid, or branched – 19 kb length, 60–80 nm in diameter – Negative-sense enveloped RNA (3' to 5' direction) – "Spikes" appearance – 8 sub-genomic mRNA proteins: 7 structural and 1 nonstructural.

> Ebola Pathogenesis • Enters Bloodstream – skin, membranes,open wounds • Cell Level – docks with cell membrane • Viral RNA – released into cytoplasm – production new viral proteins • New viral genomes – rapidly coated in protein – create cores • Viral cores – stack up in cell – migrate to the cell surface – Produce trans-membrane proteins – Push through cell surface – Become enveloped by cell membrane • ssRNA- Genome Mutations – Capable of rapid mutation – very adaptable to evade host defenses and environmental change ebola -Attach to walls- Leakage of blood and serum into surrounding tissue Wbcs' attack Wbcs' dissolve Chemical released Pro-inflammatory cytokines Pro coagulants Also released Blood vessels more damaged Permanent bleeding Entire body leaks and dissolves. (Muradi et al., 2014)

It would seem, however, that effective diagnosis and prognosis of an infectious disease is no guarantee of successful treatment and cure. At this point in time the two groups of practitioners have equally failed to produce an effective cure for EVD—despite differential access to hi-tech technologies. We hope that this record would change in the future, and that a cure emerges for this deadly disease that brought about the death of about ten thousand victims in Liberia, Guinea and Sierra Leone between 2014 and 2015. Meanwhile, however, contact tracing remained the most positive of options available (Uche, 2014).

On their part, the practitioners of traditional medicine complain that they are inadequately compensated, and seldom acknowledged for their accomplishments, by governmental officials as well as individual beneficiaries of their treatment. They have difficulty feeding their families on the paltry sums given to them by clients. Scholars doing research benefit from their botanical expertise and knowledge but often do not acknowledge adequately the source of their information. (Tarus, 2013). African traditional practitioners also complain that they are not given funding to support the numerous experimentations that they engage in with respect to herbal products through their trial-and-error evaluations and otherwise. They accuse pharmaceutical companies of failing to share the vast proceeds and profits they accumulate—even when their products are the synthesized version of plants traditional practitioners initially identified locally. Practitioners complain of the violation of their intellectual property rights and underpayment for their intellectual skills. These grouses are not without merit. In their research on indigenous knowledge systems in Botswana, Andrae-Marobela et al. admitted that there was "no policy in place that clarifies the legal status, rights and needs of traditional healers and traditional medicine in general" (Marobela et al., 2012, p. 243). Others acknowledge that ATM practitioners derive meager benefits in exchange for their innovative work (Tarus, 2013).

We shall now examine the paths of intersection of mainstream medical research and traditional medicine, and allude to verification and evaluation in the course of discussing relevant phytochemical reports.

PHYTOCHEMICAL ANALYSIS AND AFRICAN TRADITIONAL MEDICINE

As pointed out earlier in this chapter, most prescriptions of traditional practitioners are plant- based (Guantai & Chibale, 2012, p. 102). Differentiation is made between the flowers, leaves, bark and root of the plants, invariably used in the form of essential oils, elixirs, infusions, enemas, suppositories, balms and pills. In her focus on East Central Africa, Waite has provided a detailed analysis of some of the plant products popularly utilized and used regionally for coughs, as abortifacients and for stomach disorders (Waite, 1992, pp. 28–33).

We shall now focus on some plant products that are commonly recommended by traditional medical practitioners in various parts of the continent. We identify some of the ailments for which they have been prescribed and reflect on their medicinal efficacy, from the standpoint of analytical chemists and botanists as well as traditional practitioners themselves. We have reluctantly placed in brackets the Latinized botanical names. Decades ago, we argued against the use of this Eurocentric system of naming. We believe that the way out of the morass, at this point in time, is to use the bracketed Latinized terms, side by side with the local names, for interregional understanding. African researchers in the botanical field are still in the process of compiling an alternative corpus of terminologies to date.

Our list of plant products includes Bissap or Sorrell (*Hibiscus sabdariffa*), Marula (*Sclerocarya birrea*) and the African potato (*Hypoxis hemerocallidea*) as well as two important immune boosters, Baobab (*Adansonia digitata*) and Moringa (*Moringa oleifera*).

One of the most remarkable plants that we should note is Bissap**,** also known as *Hibiscus sabdariffa.* Traditional practitioners routinely use it in the treatment of abscesses, obesity, cough, cancer, debility, hypertension, heart ailments and neurosis. There are hundreds of species but the one we focus on here is *sorrel* or *bissap*: The flowers are often red and the petals and calyces abound in nutrients such as calcium, phosphorus, iron, zinc and beta carotene; the seeds contain a high percentage of calcium, zinc, magnesium and other nutrients; the leaves have no noticeable toxins. When analyzed in the laboratory, *Hibiscus* extract showed strong anti-bacterial potency and proved to be effective in protecting cells from damage (Da Costa et al., 2014). Based on such laboratory testing, the plant has been considered effective in the treatment of diabetes, and high blood pressure, and in combating bacteria, parasites, fungi and tumors (Tom Villani et al., 2014). The point is made that *Hibiscus* does not contain as much vitamin C as the fruit of *Baobab* but is also a useful immune booster and can strengthen the body's ability to fight viruses. Such reports point out that the phytochemicals found in the plant include phenolic acid, flavonols, anthocyanins, sterols, tocopherols, volatiles, and fatty acids (Villani, 2013)—compounds that explain the effectiveness of the plant as an antibacterial, anti-parasitic, anti-hypertensive, anti-tumor and anti-obesity agent. Villani points out that the polyphenols explain the antioxidant features that are "useful in protecting cells from oxidative damage and scavenging free radicals, especially in liver cells"

(Villani, 2013, p. 220). It would seem that both traditional and orthodox practitioners think highly of this plant product for the treatment of specified ailments and there is a relative convergence of views and assessments.

There is extensive use of Marula (*Sclerocarya birrea*) in ATM for the treatment of diabetes, dysentery, gastro-enteritis and diarrhea (Prinloo & Street, 2013, p. 21). Various parts of the plant have been used. Decoction of the root and bark, and infusions of the leaf have been prescribed as enemas, and for a range of ailments, including dysentery and diarrhea. The leaf has been used to make decoctions for the treatment of diabetic patients. Prinloo & Street discuss the report of clinical studies in diabetic rats treated with extracts of the bark and conclude that results show a reduction in blood glucose levels (Prinloo & Street, 2013). Conventional laboratory researchers found antibacterial activity in leaf and twig extracts against four types of bacteria. So we have here another case of convergence in the value for both the conventional practitioners and the practitioners of ATM, especially with respect to diabetic patients.

According to David Katerere, the African potato (*Hypoxis hemerocallidea*), also called *Star Flower* and a host of other names, has been used for treating prostrate disorders, intestinal parasites and some sexually transmitted diseases by ATM practitioners. Researchers attested to a high concentration of phytosterols. Katerere considered that this feature explained its effects on the prostrate (Katerere, 2013, pp. 51–62). Clinical studies have demonstrated that extracts of the African potato reduced the seriousness of diarrhea in rodents. The efficacy of the plant for the treatment of HIV and sexually transmitted diseases has been less positive from the standpoint of conventional laboratory research, however, and here lies a major area of dissonance between conventional medical research and ATM.

IMMUNE BOOSTERS

Baobab (*Adansonia digitata*), Moringa (*Moringa oleifera*), Bitter Gourd (*Momordica cochinensis*), Ethiopian Mustard (*Brassica carinata*), Spider Flower (Cleome gynandra), Amaranth (*Amarantius tricolor*), Ewedu, also known as Jute (*Corchorus*), Snake Gourd (*Trichosanthes cucumerina*), and Cowpeas (*Vigna unguiculata*) are among several of the local plants highly cherished by African traditional practitioners as tonics and nutrients. Phytochemical analysis suggests that each of these plant products has an extremely high content of vitamin C—far beyond that of an orange (50mg/100g). They are viewed as excellent immune boosters based on their high vitamin C composition (Yang et al., 2013, p. 244). These plant products are also viewed as rich in vitamin A and E and other nutrients. Their high esteem as restorative tonics by the ATM practitioners correlates with the conventional perceptions and analyzes.

One of the commonly used products in traditional medicaments is Baobab (*Adansonia digitata*). We have come to realize, on the basis of phytochemical research, that its seeds are very rich in calcium and magnesium and have a bit of

zinc, despite some toxins such as tannins and phytic acid. The seeds could be roasted or sundried and that would get rid of the tannins. This process, however, could also generate some other chemical reactions, according to De Caluwe, Halamova and van Damme (De Caluwe et al., 2009, pp. 51–84). Nnam and Obiakor tried fermentation of the seeds for six days and reported great results (De Caluwe et al.). The fruit pulp does not have such anti-nutrients but to retain maximum amount of Vitamin C, you have to eat it raw, according to these researchers. They suggest that an orange has about 50 mg/100 g fresh weight; but the pulp of the baobab can have as much as 5000 mg/100 g in weight, making it 100 times more than an orange. (Many trees contain much less than that in terms of the fruit pulp and may have an average of 300 to 500 mg). The fruit also contains small levels of lutein and carotene (De Caluwe et al.). So in terms of nutrition, and as an immune booster, the baobab is by no means overrated, going by phytochemical reports. Its choice as a valuable asset in traditional medical practice points to a convergence of positive assessments of this product by both the ATM practitioners and mainstream medicine.

In the case of *Moringa* (*Moringa oleifera*), regionally known as *ikwe oyibo, nebeday, zogali, gawara,ewe ile, mzunze, acacia branca and/or kpatima,* the young shoots are viewed by laboratory research as richest in Vitamin C (*Lost Crops*, 2006). Phyto-chemical analysis points out that the leaves contain Vitamins A and B, protein, calcium and iron; its pods are high in Vitamins C, A, and B, with higher iron content in the pods than in the leaves (Mensah et al., 2008). The oil from the seeds is seen as somewhat comparable to olive oil (Lost Crops, 2006); its flowers are rich in protein, minerals and vitamins, and so, too, the roots. It is seen as a useful builder of the immune system, given its high vitamin C content (Mibei et al., 2012). Phyto-chemical analysis implies that those traditional practitioners that prescribe it in the treatment of anemia and other nutritional deficiencies do so appropriately.

CONCLUSION

We have focused on African Traditional Medicine and some of its diagnostic procedures and preventive and curative medicinal techniques. We have also reflected on various agents and agencies associated with its methodology. Some of its assumptions about plant products were identified. We focused also on some of the criticisms levied against traditional medical practitioners. We argued that phytochemical analysis implied that many of the plant-based medicaments of the traditional ATM practitioners, had active ingredients with the capability to carry out the intended curative and preventive functions. Should indigenous knowledge practitioners take note of such laboratory tests? Does the use of such reports take away from the authenticity of indigenous knowledge? Should we apply contemporary and ongoing processes of conventional authentication in evaluating such medicaments? If not, what mode of verification should we utilize? To what extent do medicaments prescribed by traditional practitioners correlate, intersect

and converge with "mainstream" science? Does phytochemical testing imply the start of a collaborative venture between the two traditions. Is this desirable? Should ATM and conventional medicine be components of a unified science or must ATM blossom autonomously? We encourage future researchers to explore some of these issues, and expand our collective understanding of the ethical and epistemological challenges, and the strategic directions and way forward for ATM.

REFERENCES

Abdalla, I. (1997). *Islam, medicine and practitioners in northern Nigeria*. Leviston, NY: Edwin Mellen.

Allen, J. (2005). *The art of medicine in ancient Egypt*. New York, NY: Metropolitan Museum of Art.

Adodo, A. (2013). *Nature power—Natural medicine in tropical Africa*. London: Authorhouse. (*Lost Crops of Afric*a, vol. 2. Washington, DC: National Academies Press, 2006.)

Andrae-Marobela, K., Ntumy, A. N., Mokobela, M., Dube, M., Sosome, A., Muzila, M., Ngwenya, B. N. (2012). Now I heal with pride—The application of screens-to-nature technology to indigenous knowledge systems research in Botswana: Implications for drug discovery. In K. Chibale, M. Davies-Coleman, & C. Masimirembwa (Eds.), *Drug discovery in Africa: Impacts of genomics, natural products, traditional medicine, in pursuit of new drugs*. New York, NY: Springer-Verlag.

De Caluwe, E., Halamova, K., & Van Damme, P. (2009). Baobab (Adansonia digitata L.): A review of traditional uses, phytochemistry and pharmacology. In R. H. Juliani, J. Simon, & C-T. Ho (Eds.), *African natural plant products: New discoveries and challenges in chemistry and quality*. Washington, DC: American Chemical Society.

Emeagwali, G. (Ed.). (1993). *Historical development of science and technology in Nigeria.* Lewiston, NY: Edwin Mellen.

Emeagwali, G. (Ed.). (2006). *Africa and the academy. Challenging hegemonic discourses on Africa.* Trenton, NJ: AWP.

Emeagwali, G., & Dei, G. (Eds.). (2014). *African indigenous knowledge and the disciplines.* Rotterdam, The Netherlands: Sense Publishers.

Finch, C. (1990). *The African background to medical science: Essays on African history, science and civilizations*. London: Karnak.

Guantai, E. M., & Chibale, K. (2012). Natural product – based drug discovery in Africa: The need for integration into modern drug discovery paradigms. In K. Chibale, M. Davies-Coleman, & C. Masimirembwa (Eds.), *Drug discovery in Africa.* New York, NY: Springer.

Juliani, R. H., Simon, J. E., & Chi-Tang Ho. (2013). *African natural plant products*. *Vol. 11: Discoveries and challenges in chemistry, health, and nutrition.* Washington, DC: American Chemical Society & Oxford University Press.

Katerere, D. (2013). Hypoxis hemerocallidea (African potato): A botanical whose time has come? In R. H. Juliani, J. E. Simon, & Chi-Tang Ho (Eds.), *African natural plant products* (Vol. 11). Washington, DC: American Chemical Society & Oxford University Press.

Kuete, V. (2013). *Medicinal plant research in pharmacology and chemistry*. London: Elsevier.

Mensah, R. J., Okoli, O., Ohaju-Obodo, J. O., & Eifediyi, K. (2008). Phytochemical, nutritional and medical properties of some leafy vegetables consumed by Edo people of Nigeria. *African Journal of Biotechnology, 7*(14), 2304–2309. Retrieved October 8, 2015, from http://www.ajol.info/index.php/ajb/article/view/58988/47301

Mibei, E. K., Ojijo, N. K. O., Karanja, S. M., & Kinyua, J. K. (2014). Phytochemical and antioxidant analysis of methanolic extracts of four African Indigenous Leafy vegetables. *Annals Food Science and Technology, 13*(1), 37–42. Retrieved October 8, 2014, from http://www.afst.valahia.ro/docs/issues/2012/issue1/full/section2/1-EliasKMibei.pdf

Minimberg, D. (2005). The legacy of ancient Egyptian medicine. In J. Allen (Ed.), *The art of medicine in ancient Egypt*. New York, NY: Metropolitan Museum of Art.

Murali, S., Arya, A. K., Chaudary, M., Dama, N., Doshi, A., & Godage, M. (2014). *Ebola*. Retrieved October 8, 2014, from www.slideshare.net/nileshdama7/best-ebola-ppt?related=2

Nimoh, S. (2014). Indigenous traditional medicine in Ghana: Tapping into an under-explored resource. In G. Emeagwali & G. J. S. Dei (Eds.), *African indigenous knowledge and the disciplines*. Rotterdam, The Netherlands: Sense Publishers.

Ogbonnia S., & Anyakora, C. (2006). The chemistry and biological evaluation of Nigerian plants with anti-diabetic properties. In H. R. Juliani, J. E. Simon, & Chi-Tang Ho (Eds.), *African natural plant products.* Washington, DC: American Chemical Society & Oxford University Press.

Pankhurst, R. (1990). *The medical history of Ethiopia.* Trenton, NJ: Red Sea Press.

Prinsloo, G., & Street, R. (2013). Marula: A review of traditional uses, phyto-chemistry, and pharmacology. In R. H. Juliani, J. E. Simon, & Chi-Tang Ho (Eds.), *African natural plant products. Vol 11: Discoveries and challenges in chemistry, health and nutrition*. Washington, DC: American Chemical Society & Oxford University Press.

Da Costa Rocha, I., Bonnlaender, B., Sievers, H., Pischel, I., & Heinrich, M. (2014). Hibiscus sabdariffa L. – A phytochemical and pharmacological review. *Chemistry*, *165,* 424–443. Retrieved December 15, 2014, from http://www.sciencedirect.com/science/article/pii/S030881461400692XFood

Sofowora, *A.* (1982). *Medicinal plants and traditional medicine in Africa*. Chichester: Spectrum Books and John Wiley & Sons.

Some, M. (1999). *The healing wisdom of Africa*. New York, NY: Penguin Putnam.

Tarus, P. (2013, March). *Reflections on research on african traditional medicine*. Interview. [MPEG]. Retrieved from http:// www.vimeo.com/61586008

Uche, J. (2014). *Integrating GIS and remote sensing technology in contact tracing of ebola virus disease cases in Nigeria*. Retrieved October 8, 2014, from http://www.slideshare.net/anumbajoe/integrating-gis-and-remote-sensing-technology-in-contact-tracing-of-ebola-virus-disease-cases-in-nigeria

Waite, G. (1992). *A history of traditional medicine and health care in pre-colonial Africa.* Lewiston, NY: E. Mellen Press.

Yang, R., Fischer, S., Hanson, P. M., & Keatinge, J. D. H. (2013). Increasing micro-nutrient availability from food in Sub-Saharan Africa with indigenous vegetables. In R. H. Juliani, J. E. Simon, & Chi-Tang Ho (Eds.), *African natural products. Vol. 11: Discoveries and challenges in chemistry, health and nutrition* (pp. 231–254). Washington, DC: American Chemical Society & Oxford University Press.

CHARLES O. ALUEDE AND VINCENT AIWUYO

14. ETHNOMUSICOLOGISTS AND MEDICAL PRACTITIONERS IN HEALTHCARE DELIVERY IN NIGERIA

INTRODUCTION

This chapter focuses on music therapy and wellness. The study relied on a blend of anthropological and ethnological, historical and literary techniques in eliciting its data. Consequently, it takes a historical look at how certain prehistoric constructs have provided the scientific basis for modern medical practices, and argues further that learning from the past, and agreeing to work together in the present, would without doubt initiate a breakthrough in healthcare delivery in the Nigerian future. That music as a construction of the human brain has multifarious functions is not controvertible. The views of Chanda and Levitin (2013, p. 179) are informative. They opine that:

> Music is one of a small set of human cultural universals, evoking a wide range of emotions, from exhilaration to relaxation, joy to sadness, fear to comfort, and even combinations of these. Many people use music to regulate mood and arousal, much as they use caffeine or alcohol. Neurosurgeons use it to enhance concentration, armies to coordinate movements and increase cooperation, workers to improve attention and vigilance and athletes to increase stamina and motivation.

Earlier, Levitin (2012) observed that music itself also functions as 'amphetamine' and 'barbiturate' do. If this view is to be held on to, it means that music can as well function as medicine and if so, the onus is on everyone concerned with health and healing to explore healing through music as a major tool in modern healthcare delivery. There is perhaps an obvious reason why music in healing should be explored. Apart from musicogenic epilepsy which is attributable to music (Benson, 2012), no side effect is noticed with musical intervention in the wellness of a patient, as against the use of drugs (Cortrell, 2002).

WHAT IS MEDICAL ETHNOMUSICOLOGY?

According to Koen in Koen et al. (2008, pp. 3–4):

> Medical ethnomusicology is a new field of integrative research and applied practice that explores holistically the roles of music and sound phenomena

G. Emeagwali & E. Shizha (Eds.), African Indigenous Knowledge and the Sciences, 171–181.
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> and related praxis in any cultural and clinical context of health and healing. Broadly, these roles and praxes are viewed as being intimately related to and intertwined with the biological, psychological, social, emotional and spiritual domains of life, all of which frame our experiences, beliefs and understandings of health and healing, illness and disease, and life and death.

In Nigerian societies, the remedy to physical manifestation of an illness is first sought medically, and, if prolonged, other probing alternatives will be sought and these include cultural, sociological, musical, psychological counseling and spiritual approaches. This is why in examining the case history of a patient, his culture, family background, religion, social beliefs, occupation and a host of other variables are brought under scrutiny so as to bring a balance or stability in the patient's health.

ON THE THERAPEUTIC USE OF MUSIC

Music therapy is the clinical and evidence-based use of music interventions to accomplish individualized goals, within a therapeutic relationship, by a credentialed professional who has completed an approved music therapy program (American Music Therapy Association [AMTA], 2014). It is "the art of using musical sounds in bringing changes from undesirable unhealthy conditions to a more comfortable one in a person's life." Music as a healing force has a long history dating back many centuries. It was well recognized by the Greeks who have Apollo as the god of music and medicine (Misic et al., 2010). In Africa, the Egyptians used music therapy in the temples. The Native American medicine men used chants and dance as healing methods for patients. An important figure with great interest in how music affects humans was the Greek philosopher Plato.

A modern form of music therapy was said to have begun after World War II when musicians travelled to hospitals playing music for soldiers having emotional and physical trauma (Degmecic et al., 2005). Music has been found useful with proven evidence in certain health conditions. It has been found helpful in children having problems with communication, motivation, attention and behavioural difficulties (Brunt & Hoskyns, 2002). Modern healthcare has recognized and is utilizing the benefit of music in therapeutic modification of symptoms of mental disorders such as schizophrenia, Alzheimer's disease, parkinsonism, depression, dementia and mood disorders (AMTA, 2014; Brunt & Hoskyns, 2002). A study carried out by Field et al. (1998), indicates that music reduces stress hormone (cortisol) levels significantly, and can shift depressed adolescents towards positive affect. To corroborate this finding, the American Music Therapy Association (2014) asserts that when music is used therapeutically, it reduces muscle tension; decreases anxiety and agitation; enhances interpersonal relationships; increases motivation, self-esteem and self-image; improves group cohesion; and increases verbalization and emotional release. Most of these items mentioned above are symptoms related to mental illness.

Research has also proven that it enhances immune systems functions; reduces heart rate and modulates breathing; and increases endorphin production—which reduces pain (Ibrahim, 2014).

In traditional African healing settings, music is used to reduce anticipated pains therapeutically, as evidenced in circumcision and orthopedic (bone-setting) ceremonies, and it also serves in palliative care for patients with life-threatening illnesses directly after diagnosis, as practiced in Tanzania. Ethnic music (traditional healing songs) can be employed in mental institutions and hospitals to improve patients' emotions, tolerance and compliance to medications. Scientifically proven therapeutic benefits of music from research abound. A study by Leardi (2007) shows that brief drumming sessions can double alpha brain wave activities dramatically reducing stress. It has also been demonstrated that there is improvement in stress response following musical therapy in surgery and schizophrenia (Leardi, 2007; Gold, 2007; Gold et al., 2005 & Tang et al., 1994).

In Nigeria, healing songs play vital and initiating roles. To many orthodox medical personnel, this has not been proven through evidence-based research. In an effort to subject discoveries to rigorous scrutiny, all the concerned parties would need to evolve a common template for the assessment of progress in this direction. This should be the case because while orthodox medical practitioners may be most concerned about clinically-based research evidence, experts from other backgrounds may be insisting on other variables than the clinical. This is so because to many Africans, there are multiple variables in disease causation.

RELIGION, MUSIC AND MEDICINE: ANY CONNECTION?

Religion, music and medicine have a long standing tripartite connection and there are copious references to the use of music in healing in most religious scriptures. The coincidence of music and religion is strikingly widespread. This is true because some of the purposes of religious services and music performances are very similar. The great value that both music and religion possess is to draw people together. Music and religion are often at their peak function when they are group activities (Gaston, 1968, pp. 22–23). While examining this tripartite web, the trio Schneider, Unikefer and Gaston (1968) remarked that music and therapy have been close companions, often inseparable, throughout most of history. Each culture has determined the nature and use of its music in the treatment of illness. Mystic, therapeutic powers have often been attributed to music, even in cultures that took pride in their rationality. Men and women believed that music cured illness by warding off evil spirits, absorbing sins, introducing moral and ethical forces into human lives and placating the gods.

Amazing though, and perhaps in a deliberate effort to remove medicine far from the arts, came the conspiracy of dichotomization and disintegration of a one-time collective field. In ancient Egypt, illness was believed to be caused by good and

evil spirits and in the medieval and renaissance eras of Europe, a new trend evolved which enlarged the concept of illness causation in those nations (Davis, 2013).

ILL-HEALTH AND HEALING IN NIGERIA

The World Health Organization (WHO, 1946) defined health as "a state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity." Despite the above definition, there are other views regarding health. The aboriginal people of Australia believe "that health does not just mean the physical wellbeing of the individual but refers to the social, emotional, spiritual and cultural wellbeing of the community" (NHMRC, 1996).

In the African and Nigerian traditional settings, illness causation is viewed as natural, pre-natural and supernatural. According to medical anthropologists, illness refers to the psycho-social experience and meaning of the perceived disease for the individual, and those associated with the individual such as family members. Clearly, multiple factors influence the health and wellbeing of the individual, and therefore the means and modalities of treatment or management of the perceived illness.

Besides medical interventions and individual surroundings, many other factors have been documented to influence the health status of a person, including his or her lifestyle, social and economic standings and cultural background (Kangwa, 2010). Globally, the modern and current practice in the management of ill-health or disease emphasizes a broad holistic approach, utilizing all disciplines or professions relevant and readily available to bring about the prompt return of the affected individual to a healthy state. However, the applied methods or modalities must be tested, proven and deemed acceptable, with no adverse effects, and should have beneficial outcomes for the individual. This is the basis for the emergence of collaboration and integration of proven alternative and palliative medicine with orthodox medicine, in the management of certain illnesses, in some parts of the world. In Africa, in general, and Nigeria, in particular, much is yet to be seen in this regard. Instead, orthodox practices and traditional healing practices operate in parallel, with the latter relegated to the background.

Traditional healing practitioners in Nigeria can be grouped into herbalists, faith healers and psychics. In all these practices music, in one form or the other, is employed to accomplish the task of healing.

DISEASE CAUSATION

Even in its wide landmass, multiplicity of languages spoken, religious beliefs and cultural mores, there appears to be a general consensus on the concept of illness and illness causation in Nigeria. What constitutes illness and its aetiology has been reported by many Nigerian scholars. To them, illness causation could be natural, preternatural and supernatural (Osunwole, 1996; Erinosho, 1998). While studying the thought construct of illness causation of the Esan in Edo State, Nigeria, Aluede

(2008) concluded that for these communities, illness could be naturally and ancestrally induced, carried over from a previous earth life or magically induced through witchcraft. The fascinating if not startling revelation is that, even in the traditional milieu, illness is known to be caused by a multiplicity of variables, including germ theory. This is aptly captured by Izugbara and Duru (2009) when they remarked that:

> In the Igbo worldview, health and disease are consequent upon the interaction of an individual and all these spheres; he/she enjoys good health. Ill-health often results from an imbalance in the individual's interaction with the environment. Igbo enthnomedical cosmology recognizes three broad illness classifications; natural, mystical, and inherited. Natural causes of disease conditions include drinking of unclean water, overeating, lack of rest, overindulgence in sex, ingestion of poisonous substances, exposure to inclement environment etc. Researches take this as evidence that the Igbo view acknowledges the germ theory of disease causation. (p. 33)

In other African societies, the theory of illness causation appears to be similar. While reporting the scenario in Malawi, Friedson (1996, pp. 40–41) concluded that spirits were only one of three possible causes of disease (*Nthenda)* in the Tumbuka theory of illness. God and witches (*Bafwiti*, plural of *Mfwiti*) were the other etiologic agents. Any one of these agents could manifest identical symptoms in a person who is ill. Since the same set of symptoms might be caused by different sources, illness was not classified, nor was therapeutic intervention initiated, according to symptomatology, but rather according to which agent was responsible for the illness. He stresses this fact further when he asserts that:

> Throughout Africa there is a dualistic system of medical care. Every country in Africa has Western-style hospitals that, in varying ways shaped by local conditions, deliver healthcare in the western mode: antibiotics are dispensed, X-rays taken, babies immunized, broken bones set, and operations performed. But everywhere we find Western medicine in Africa, we also find older and more widespread, parallel, indigenous systems of healthcare. Contrary to the expectations of Western medical practitioners, the "miracle" of modern medicine has not supplanted traditional healthcare practices in Africa. (Friedson, 1996, p. 43)

While looking at adjacent nations of the west, Weil (1998, p. 50) reports that the law of chronic disease states that when disease persists despite treatment, it is the result of one or more conditions that affect many people and have been driven deep inside the body by earlier allopathic therapy. He opines further that orthodox medicine views the human organism as a complicated mechanism. It minimizes or ignores consciousness and mind as important determinants of health, illness and responses to treatments. Orthodox medicine also likes to call itself scientific and imagines that its exclusive attention to the physical reality of bodily mechanisms

is in the best spirit of twentieth-century science. What most medical doctors do not know is that the scientific model of reality has changed radically since 1900 and no longer views the universe as an orderly mechanism independent of the consciousness observing it (Weil, 1998, p. 257).

Cross-examining the divergent views of Friedson (1996) and Weil (1998), one sees that the poor recognition of the role of the mind in illnesses may without doubt affect proper healthcare delivery. For example, it is now common knowledge that the sugar level in the blood increases when a person is anxious, and that when gripped by fear, the number of white corpuscles in the blood decreases. Thus emotions play significant roles in bringing about changes in the body (Ganesam, 2006, p. 48). In another development, today in American medical schools, emphasis is now placed on the acquisition of a good background in the arts. This kind of knowledge equips the medical personnel in asking thorough questions on the family traditions, beliefs, religion and worldview. It is therefore thought that since music has much grip upon the human mind it should be employed alongside other supports to bring good health. Music is more mysterious than language…Everyone knows what music is but cannot delimit its boundaries. The concept of music is variable; some cultures have no separate term for music, including dance and music in the same category. Regardless of definitional problems, the musical capacity can be studied rigorously.

In traditional societies, there have been high measures of musicomedical ceremonies. In these ceremonies, music alone or music alongside other therapeutic agents were employed to occasion healing. Many such traditions require in-depth study so that proper documentation can be done. Once documented, researchers from diverse backgrounds can tap such knowledge for the good of humankind.

WILL THE MARRIAGE OF THESE BLOCKS BE BENEFICIAL?

Obviously in Africa, in general, and Nigeria, in particular, two parallel healthcare systems exist, namely, the modern healthcare system and the traditional medical system that is in the background. The traditional medical sphere can further be fragmented into traditional medicine and complementary or alternative medicine. It is important that this distinction be made for the purpose of clarity. Traditional medicine (TM) "is the sum total of the knowledge, skills, practices based on the theories, beliefs and experiences indigenous to different cultures whether explicable or not, used in the maintenance of health, as well as in the prevention, diagnosis, improvement of physical and mental illness" (WHO, 2000). Complementary medicine and/or alternative medicine refers to traditional medicine in countries where the dominant health system is based on biomedicine, and traditional medicine has not been incorporated into the national healthcare system.

Body and mind intervention is one of the five sub-classifications of Complimentary/Alternative Medicine (CAM), and includes patient support groups, meditation, prayers, spiritual healing, and creative outlet therapies involving the arts, music and dance (Heather & Chiho Chung, 2012). There is no doubt that music is a

globally recognized means of healing. A few countries, such as China, the Republic of Korea, Vietnam and the Democratic Peoples' Republic of Korea have been able to completely integrate or synergize traditional healing practices (TM/CAM) into their health systems (WHO, 2002).

However, Nigeria can be said to be in the inclusive system of integration. Music, which is an aspect of CAM, has gained recognition in the Western world as an adjunct to healing and wellbeing of the individual, and it is being integrated into the mainstream healthcare system, especially in Europe and the United States. Sadly, the same cannot be said about Nigerian music healing. The relevant bodies in Nigeria have recognized herbal medicine partially. One cannot deny the fact that holistic integration of proven evidence-based music healing and appropriate and effective utilization of proven ethnic healing music will have immense benefit to the individual and the health system in general.

Achieving this goal of integration will require the collaboration between relevant government agencies and the various health-related disciplines. Furthermore, some difficulties that could also hinder synergy and integration may include: difficulties in agreeing on criteria for evaluating, targeting and selecting practices for collaboration and integration. Also, there are the difficulties in designing educational and training strategies resulting from variations in concepts of illness in different cultures. Perceptions of causation and treatment strategies vary among healers, with inadequate data on beliefs and practices of specific cultures. Somehow, there is paucity of research on the effectiveness of healing processes and ritual procedures. There are also ethical considerations bordering on confidentiality.

However, there is increasing awareness on the need for a common platform on which traditional healing/complimentary medicine and orthodox practices could be integrated, thereby providing totally improved health and wellbeing for the individual. This collaboration and integration will lead to the development of a modified healthcare system utilizing all relevant disciplines that will avail the patient total care. Integration of ethnic music in healing practices can be facilitated by allowing claims of healing effects to be subjected to scientific testing and validation. This will boost acceptability when proven, and hence encourage integration and collaboration. This has been done with herbal drugs in Tanzania where some herbal efficacies are being tested in a scientific institute (Madamombe, 2006). According to Moreno (1995), in the USA and Europe music is used as an adjunct to medication with the aim of treating other areas that drugs cannot take care of, such as psychological trauma associated with chronic illness, and in such cases, doctors diagnose and treat patients and refer those needing music therapy to the musical therapist. Likewise, proven ethnic healing music can be applied in Nigeria if there is integration in the healthcare system.

Music healing has not been publicly recognized in Nigeria as a form of therapy except in the traditional or cultural settings, and added to this, music is intertwined with other processes in the healing rituals, casting doubts on the absolute efficacy of the healing property of music in such ceremonies. Therefore, subjecting this to

collaborative research shall further improve and enhance synergy. This fact was noted by Moreno (1995), who pointed out "that interdisciplinary research has helped to provide measurable data that support the value of music in healing." Policies by the concerned governmental authorities that favour creation of awareness, establishment of research and collation centres, training and registration of competent practitioners will facilitate synergy and integration.

Health-system integration in Nigeria is in the inclusive stage whereby traditional/ alternative medicine is recognized but not yet fully integrated into all aspects of the healthcare system (Heather & Chiho Chung, 2012). It is therefore hoped that as a form of alternative medicine, ethnomusic therapy will be recognized alongside others. More research should be done in this area. Incorporating the teaching of this practice (field) in the universities and possibly the teaching hospitals and medical schools will enhance research interest in this field and therefore integration and collaboration.

For too long, outside the field of medical anthropology, traditional music and healing practices have been viewed as primarily of musical and anthropological rather than medical interest. We strongly suggest that the time is long overdue to seriously consider these musical traditions for the explicit purpose of determining their potential practical applications in the modem healthcare setting. Collaborative research between music therapists, ethnomusicologists, medical anthropologists and medical personnel can lead to the development of a new and integrated discipline that we propose should be termed *ethnomusic therapy* (Moreno, 1995, p. 336). While a hasty move to coin a practice which has been in existence since the origin of the human race is not immediately advocated in this chapter, it is vital to stress that since illness causation is attributable to many variables, with music healing either serving as the core or epiphenomena, and with orthodox medicine being part of the web, it is thought that a more encapsulating nomenclature should be sought.

The long-standing history of music in human lives has in itself given it wide latitude of coverage. For example, it is absolutely difficult to specifically box music into the arts. It is in the arts, sciences, social science and lots more. According to Roseman (2008, p. 19):

> We are talking across disciplinary divides where historical artifacts of the institutionalization of knowledge continue, by and large, to place music, ethnomusicology, and religion in the humanities; medicine in the biological sciences; and anthropology and psychology in the social sciences. Recalling the human in humanities and the behavioural in the sciences constitutes one such step across their divide. A subject like musical healing calls upon us to talk across our disciplines…

No doubt, music healing is of many strands and so requires concerted study and application from a wide range of fields. Music healing should be studied beyond initial barricades and borders if holistic healing is to be achieved. Oyelakin (2009, p. 73) argues to reject the call that Yoruba traditional medicine should be integrated

into orthodox medicine. To him the art has developed on its own, such that the secret and so-called magical processes are objectified. If Yoruba traditional medicine has been developed and used to serve humanity on its own, independent of the orthodox one, then the call for integration is unnecessary and lacks justification. However, Nwoko (2009, p. 36) opines that in recent times, there have been debates among health professionals on the desirability of integrating traditional health practices into orthodox healing methods, as well as proven traditional healing processes, in the treatment of some ailments.

Without much debate, many gains may be accruable to communities where this kind of synergy is encouraged. The proposal for integration is borne out of many variables. The demographic changes that are taking place have very important implications for music therapists. If unaware of the importance of cultural differences, they may engage in cultural oppression using unethical practices (Bradt, 1997, p. 137).

CONCLUSION

In this chapter, we have interrogated the connection between religion, music and medicine. The concept of illness and healing in the ancient era was also examined. From these historical antecedents the discussion on the concept of illness and its causal factors in Nigeria were put under focus. Having looked at how illnesses have been conceived and at healing techniques in the past, the authors opined that a marriage of medical ethnomusicology and medical practice would be beneficial to the citizenry.

REFERENCES

Aluede, C. O. (2005). An assessment of healing in African belief and modern day Pentecostal Churches. *Nigerian Journal of Christian Studies*, *1*(1), 93–106.

Aluede, C. O. (2006). Music therapy in traditional African society: Origin, basis and application in Nigeria. *Journal of Human Ecology*, *20*(1), 31–35.

Aluede, C. O. (2008). *Music as therapy by the Iyayi Society of Edo State, Nigeria* (Doctoral Thesis). The Institute of African Studies, University of Ibadan, Nigeria.

Aluede, C. O., & Ibekwe, E. U. (2011). (Re)Investigating man, drum and music in healing. *Journal of Ethnomedicine, 5*(2), 125–131.

American Music Therapy Association. (2014). *Music therapy in mental health- evidence based practice support*. Retrieved February 22, 2014, from www.musictherapy.org

Army blue. (2014). *The provision of culturally competent health care*. Retrieved February 22, 2014.

Benson, S. (2012). *The healing musician*. Lummi Island, WA: New Grail.

Bradt, J. (1997). Ethical issues in multicultural counseling: Implications for the field of music therapy. *The Arts in Psychotherapy*, *24*(2), 137–143.

Brunt, L., & Hoskyns, S. (2002). *Music therapy: Practicalities and basic principles of music therapy* (pp. 28–39). Hove & New York, NY: Brunner-Routledge.

Chanda, M., & Levtin, D. J. (2013). The neurochemistry of music trends. *Cognitive Science*, *17*(4), 179–193.

Chiang, M. M. (2008). *Research on music and healing in ethnomusicology and music therapy* (Master Thesis). University of Maryland, College Park, MD.

Conrad, C. (2010). The art of medicine music for healing: From magic to medicine. *Lancet*, *376*, 1980–1981. Retrieved from www.thelancet.com

Crawford, M. J., Maratos, A., & Simon, P. (2011). Music therapy for depression: It seem to work but how? *British Journal of Psychiatry*, *199*, 92–93.

Davis, M. (2013). *Ideas about illness*. Retrieved September 10, 2013, from www.schoolhistory.co.uk

Degmecic, D., Pozgain, I., & Filakovic, P. (2005). Music as therapy. *International Review of the Aesthetics and Sociology of Music*, *36*(2), 290.

Erinosho, A. O. (1998). *Health sociology for universities, colleges and health institutions*. Ibadan: Sam Bookman Educational and Commercial Services.

Field, T., Martines, A., Nawrocki, T., Pickens, J., Fox, N. A., & Schanberg, S. (1998). Music shifts frontal EEG activation in depressed adolescents. *Adolescence*, *33*(129), 109–116.

Friedman, R. L. (2000). *The leading power of the drum*. Reno, NV. White Cliff.

Friedson, S. (1996). *The dancing prophets.* Chicago, IL: Chicago University Press.

Heather, M., & Chiho, C. V. (2012, May 6–9). *The integration of traditional and complementary medicine into health systems*. Paper presentation session. TBRII.

Ganesan, P. C. (2006). *Speaking of the mind therapy to cure diseases*. Berkshire: New Dawn Press.

Gaston, E. T. (1968). Man and music. In E. T. Gaston (Ed.), *Music in therapy* (pp. 7–29). New York, NY: The Macmillan Company.

Gold, C., Heldal, T. O., Dahle, T., & Wigram, T. (2005). Music therapy for schizophrenia and schizophrenia like illness. *Cochrane Database of Systematic Reviews*. Issue 3.

Gold, C. (2007). Music therapy improves symptoms in adults hospitalized with schizophrenia. *Evidence-Based Mental Health*, *10*(3), 77.

Ibrahim, B. S. (2014). *Music therapy*. Retrieved February 22, 2014, from www.irfl.org

Izugbara, C. O., & Duru, C. J. (2009). Transethnic sojourns for ethnomedical knowledge among Igbo traditional healers in Nigeria: Preliminary observations. *Journal of Anthropology: Occasional papers, 2*(2), 27–49.

Kangwa, C. (2010). *Traditional healing and western medicine: Segregation or integration?* Retrieved March 20, 2014, from www.miligan.edu/acedemics/writing/pdfs kangwa.pdf

Koen, B. D., Lloyd, J., & Brummel-Smith, K. (2008). Introduction: Confluence of consciousness in music, medicine and culture. In B. D. Koen, J. Lloyd, & K. Brummel-Smith (Eds.), *The Oxford handbook of medical ethnomusicology* (pp. 3–17). New York, NY: Oxford University Press.

Koenig, H. G. (2008). Religion, spirituality, and healing: Research, dialogue and directions. In B. D. Koen, J. Lloyd, & K. Brummel-Smith (Eds.), *The Oxford handbook of medical ethnomusicology* (pp. 46–71). New York, NY: Oxford University Press.

Koenig, H., Daniel, K., & Verna, B. C. (2012). *Handbook of religion and health*. New York, NY: Oxford University Press.

Madamombe, I. (2006). Traditional healers boost primary healthcare. *Africa Renewal*, 10.

Misic, P., Arandjelovic, D., Stanojkovic, S., Vladejic, S., & Mladenovi, J. (2010). Music therapy. *European Psychiatry*, *1*(25).

Moreno, J. J. (1995). Ethnomusic therapy: An interdisciplinary approach to music and healing. *The Arts in Psychotherapy*, *22*(4), 329–338.

Leardi, S., Pietroletti, R., Angeloni, G., Necozione, S., Ranalletta, G., & Del Gusto, B. (2007). Randomised clinical trial: Examining the effect of music therapy in stress response today surgery. *British Journal of Surgery*, *94*(8), 943–947.

Levitin, D. (2010). *The world in six songs*. London: Aurun Press.

National Health And Medical Research Council. (1996). *Promoting the health of indigenous Australians: A review of infrastructure support for aboriginal and Torres Strait Islander health Advancement; Final report and recommendations.* Canberra: National Health and Medical Research Council.

Nwoko, K. C. (2009). Traditional psychiatric healing in Igboland south-eastern Nigeria. *African Journal of History and Culture* (AJHC), *1*(2), 36–44.

Osunwole, S. A.(1996). Disease diagnosis and aetiology as a system of thought. In E. O. Oke & E. O. Owumi (Eds.), *Readings in medical sociology* (pp. 209–222). Ibadan: Resource Development and Managment Services.

Oyelakin, R. T. (2009). Yoruba traditional medicine and the challenge of integration. *The Journal of Pan African Studies, 3*(2), 73–90.

Pavlicevic, M. (2001). Music therapy in South Africa, compromise as synthesis? *Voices: A world Forum for Music Therapy.* Retrieved April 3, 2008.

Peretz, I. (2006). The nature of music from a biological perspective. *Cognition, 100*, 1–32.

Schneider, E. H., Unkefer, R. F., & Gaston, E. T. (1968). Introduction. In E. T. Gaston (Ed.), *Music in therapy* (pp. 1–4). New York, NY: The Macmillan Company.

Shayan, N., AhmadiGatab, T., Jeloudar, J. G., & Ahangar, K. S. (2011). The effect of playing music on the confidence level. *Procedia – Social and Behavioral Sciences, 30*, 2061–2063.

Tang, W., Yao, X., & Zhang, Z. (1994). Rehabilitative effect of music therapy for residual schizophrenia: A one-month randomized control trial in Shanghai. *British Journal of Psychiatry, 165*(24), 38–44.

Weil, A. (1998). *Health and healing.* New York, NY: Houghton Mifflin, Company.

World Health Organization. (1946, June 19–22). *Preamble to the constitution of WHO as adopted by the International Health Conference*, New York, NY. (Signed 22 July, 1946, and entered into force 7 April, 1948. Official records of WHO no 2, p. 100.)

World Health Organization. (2000). *General guidelines for methodologies on research and evaluation of traditional medicine*. Geneva: Author.

World Health Organization. (2002). *WHO Traditional medicine strategy*.

EVADNE E. NGAZIMBI

15. USING INDIGENOUS NARRATIVE THERAPY WITH PEOPLE OF THE AFRICAN DIASPORA

INTRODUCTION

The author discusses the role of Narrative Therapy (NT) as a postmodern theory that challenged the worldview of modern theories towards psychotherapy. NT emerged in the mid-1980s from the work of Michael White (Australia) and David Epston (New Zealand). They developed this theory based on their experiences with Australian indigenous/Aboriginal cultures, which had a completely different worldview from western cultures. This therapy has been used successfully with diverse populations for physical and mental health, in education, and even in communities to help with decision-making skills (White, 2007). The author defines the African Diaspora and identifies similarities among the people of the African Diaspora. NT sets the stage for Indigenous Narrative Therapy as practiced in Africa and the Diaspora. She describes the practice of Indigenous Narrative Therapy from three different perspectives, by therapists in three different parts of the Diaspora. The author uses a case study to illustrate her brand of narrative approach. Finally the author discusses the implications of using Indigenous Narrative Therapy in Africa and the Diaspora.

PEOPLE OF THE AFRICAN DIASPORA

There are three waves in the formation of the African Diaspora. The first consisted mainly of the involuntary and voluntary movement of large numbers of African people across the Atlantic and the Indian Ocean to the Asian subcontinent (India), North, Central and South America, and Europe before the 19th century. The second wave was the voluntary migration of Africans to different parts of the world in search of better opportunities in the 20th century and after. The current phase consists of Africans moving within Africa to create an African Diaspora in Africa. In thinking of the African Diaspora it is important to consider all the waves identified above. The common thread is that all these people are united by the fact that they share common African ancestry.

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SIMILARITIES AMONG PEOPLE OF THE AFRICAN DIASPORA

With a population projected to be 1.111 billion and made up of 54 countries, Africa is a very diverse continent. Despite this diversity, Africa and the Diaspora share many similarities in spite of the separation in time (recent versus initial immigration), distance or geographical location:

Language

During colonization and when Africans were moved to other parts of the world as slaves, it was necessary to construct a lingua franca for communication between the Africans and the westerners who were their masters. Some languages variously called patois, pidgin English, Creole, and Ebonics were born (McLaren, 2009). These languages are commonly referred to as Africanized English. Although there were disagreements about their being dialects or languages, one agreement is that they have common similarities to some Bantu languages of Africa. These similarities are based on sentence construction, reduction of consonants in words, and how past tense is used (McLaren, 2009).

Communalism Values

Generally, African cultures embrace the beliefs and values of communalism, that is, being a member of a group is valued more than individualism. Unlike most Western cultures, group membership is valued more and collaboration is encouraged more than competition. The philosophy of *Ubuntu* is based on this worldview. *Ubuntu* is a system comprising three sets of ethics: virtue, duty and situation ethics. Following these enables an individual to treat others in humane ways that make them feel valued (Dreyer, 2015). Although this philosophy arose in South Africa, it reflects the worldviews of many cultures across Africa.

Family Values

In African societies families are important, with children being valued as the bearers of culture for the future. Children are an essential component of families, and families strive to protect children (Mbiti, 1971). Besides parents who care for their children, there is a host of other available caregivers within the family: aunts, uncles, grandmothers and grandfathers. The child learns that he or she is a member of a family with communal ties. At the ages of 10–14 children learn how to contribute to family life, learning chores that contribute to the welfare of the family. Initiation ties follow during which 14-year-olds and those older get recognition from communities as young adults getting ready to take on adult roles.

Story-Telling Cultures

One of the hallmarks of African cultures is story-telling. Story-telling in African societies is the fabric that holds communities together. Story-telling fulfills a number of functions in these societies. These are: a) transmission of intergenerational transfer and change of story-telling traditions; b) transmission of cultural beliefs, norms and values; c) encouraging children to identify good from evil; d) encouraging children to be reflective beings; e) teach critical thinking; and f) encourage children to be moral thinkers (Jirata & Simonsen, 2014).

This shows that, contrary to popular beliefs, story-telling as practiced among African cultures is not just for entertainment, but serves a higher purpose to educate children as the future leaders. Additionally, children are not passive consumers of stories, but actually participate in story-telling through asking questions, urging the story-teller to continue telling the story through reflecting the emotions of the protagonists in the story, answering questions from the story-teller, and at times telling stories to their peers (Jirata & Simonsen, 2014).

The above discussion demonstrates that story-telling is not limited to adults only, but children also learn to be story-tellers at a young age. They also learn other skills e.g., being reflective listeners, learning about the cultural norms, beliefs, and taboos, etc., as they listen to and participate in story-telling. This makes using indigenous Narrative Therapy with people of the African Diaspora effective.

DIFFERENCES BETWEEN MODERN WESTERN PSYCHOTHERAPIES AND POSTMODERN THEORIES

Modern psychotherapy theories use mainly the medical model to conceptualize client issues. Typically, when a client sees a counselor, the process involves putting together information on the signs and symptoms the client has. This synthesis of the signs and symptoms results in a diagnosis. The diagnosis then guides the counselor on how to manage the client. This is in line with the medical model. The client is viewed as having a deficit within him or her that will be fixed with counseling interventions. For example, if a counselor uses Cognitive Behavioral Therapy (CBT), he or she might conceptualize the client as having deficits in thinking, namely faulty thinking. The counselor's responsibility is to use his expert knowledge and skills to help the client change his or her faulty thinking and normalcy will prevail.

On the other hand, postmodern theories conceptualize client issues as problems. Narrative Therapy is social constructionist. This means that counselors recognize that clients' problems emanate from environments they live in, specifically from the dominant discourses in society. Labeling leads to clients living self fulfilling prophecies. Thus Narrative Therapy counselors recognize that problems may be fused with the client's identity; the counselor's responsibility is to help separate the problem from the client, and help the client to rewrite his or her story and live a more fulfilling life (White & Epston, 1990).

NARRATIVE THERAPY

Narrative Therapy has been used with clients presenting a variety of mental health problems. This theory pays special attention to the use of language. Language can blur or alter experiences as well as our stories, and can affect how we think, feel and act. Language can be used as a therapeutic tool (White, 1995). It has been used successfully with individuals across the lifespan, couples, families, groups and communities. Carlson (1997) used art therapy in NT to help families work through their problems. Men who engage in domestic violence towards their partners benefited from facilitators who used NT to help them (Augusta-Scott & Dankwort, 2002). Narrative Therapy has been used in education. DiLollo, Niemeyer, and Manning (2001) showed how NT can be used to help stutterers overcome the problem of stuttering and be more fluent through changing personal constructs of themselves as stutterers to persons with stuttering problems that could be overcome. Additionally, NT can be used to help adolescents and adults with language literacy deficits (Wolter, DiLollo, & Apel, 2006).

Physical and mental health problems have been successfully addressed with Narrative Therapy. Some breast cancer survivors suffer from posttraumatic stress disorder (PTSD) due to the underlying stress of living with cancer. Petersen, Bull, Propst, Dettinger, and Detwiler (2005) successfully used Narrative-Expressive Therapy with a group of persons with cancer to prevent PTSD. Pre- and post-group test results showed reduced depression scores and eating disorder risk among women (Weber, Davis, & McPhie, 2006). Narrative Therapy has been used successfully with individuals from diverse cultures (Semmler & Williams, 2000) and in clients suffering from bipolar disorder (Ngazimbi, Lambie, & Shillingford, 2008). NT is used in informing teaching in counselor education and in supervision of counselors-in-training and counselors. Neal (1996) showed how the tenets of NT can be incorporated into and used successfully in counselor supervision. Behan explored how issues of power affect the counseling supervision relationship and dynamic (2003). The above discussion shows the versatility effectiveness of Narrative Therapy across disciplines, age groups, cultures and needs.

TENETS OF NARRATIVE THERAPY

Narrative Therapy recognizes the role of societal effects on individuals. It assumes an ecological perspective in that one cannot divorce environmental effects on an individual's health. Language plays a very important part in Narrative Therapy, as individuals make meanings of their lived experience through language. As a result, NT counselors use language intentionally, and try to match the client's language during therapy (Monk, Winslade, Crockett, & Epston, 1997). Discourses are central in NT. Dominant discourses are the well-known perspectives regarding an individual, based on the well-known stories that circulate within the community. These perspectives may mask underlying strengths about the individual (White & Epston,

1990). Dominant discourses may include labels, which might serve as self-fulfilling prophecies. An example would be if a child is told by various individuals in his or her life that the child will amount to nothing. The child might start believing that and may start to self-sabotage in order not to be successful. This label may affect the child's self-concept, and the child starts to behave according to societal expectations. At that point the child loses his or her ability to use the voice to advocate for self.

THE COUNSELING RELATIONSHIP

When the counselor and client enter the counseling relationship, the counselor explains the expectations of the client and counselor. The client is the senior partner and the expert of his or her own life. The client is the expert of his or her lived experiences. The counselor participates in the relationship as a facilitator. The counselor identifies client strengths, helps the client to see the changes he or she is making in life, and how the story is changing, eventually helping the client to rewrite his or her story. The client's life story moves from a problem-saturated story to one told from a position of strength and empowerment (White & Epston, 1990). Both client and counselor bring something valuable to the counseling relationship. They work as collaborators to fight against the problem. The counselor helps the client to explore the magnitude of the problem, and also how the client has contributed to the growth or decline of the problem. The client should be willing to do the work that is required to solve the problem (Winslade, Crocket, & Monk, 1997).

THE COUNSELING PROCESS

In working with clients, counselors focus on careful listening to the clients' stories to identify times when they reacted differently from the usual patterns. The counselor finds out what made it possible for the client to behave differently in that one situation. The counselor identifies the difference as a *unique outcome or sparkling moment.* The counselor uses this as an anchor for future sessions—this event becomes the reference for moving forward. The counselor asks the client what it feels like to be able to do things differently, and asks the client what she can do differently in order to regain those good feelings.

The counselor uses externalizing conversations to help the client separate him or her from the problem. The counselor asks the client to give the problem a name, which from henceforth would be referred to by the name. This process is crucial as the client begins to see himself or herself differently and can start re-writing his or her story.

INDIGENOUS NARRATIVE THERAPY

Practitioners use forms of Narrative Therapy (NT) in Africa and the Diaspora. However, the NT approaches used take into consideration the cultural milieu in which they are practiced. Nwoye uses a Narrative approach to child and family

therapy in Africa. As he practices he works with children and families within the confines of African family values and traditions, but his practice is influenced by Western theories, namely family therapy and Narrative Therapy.

Narrative Approach to Child and Family Therapy in Africa: Nwoye

Nwoye (2006) allows local cultural beliefs, norms and practices to influence his practice of Narrative Therapy (NT). These cultural beliefs, norms and practices include treasuring children, the importance of seniority and obedience to elders, the roles of aunties and uncles as family counselors, and the effects of urbanization and globalization on family structures. He is intentional in regards to incorporating beliefs and norms associated with childhood socialization, communication between parents and children, and communication among couples.

Nwoye (2006) identifies the differences in NT as he practices it, in comparison to White and Epston (1990). Nwoye's questions are abstract, focused on the individual, reflexive, and complex. The questions do not explore the client's perspectives on his or her relationship to the problem. On the other hand, White's approach to NT is to ask questions that explore the client's relationship to the problem. He maps the effects of the problem on the client's life and relationships. He views how the problem evolves over time. Nwoye sees psychological complaints as a reflection of emotional bruises. This is different from White's conceptualization of the problems clients bring to counseling: that they are due to the internalization of dominant discourses from society.

This illustrates that although Nwoye uses the Narrative approach in his practice, he uses the African worldview. He situates his practice within local, cultural, child and family psychology, honoring beliefs, norms and taboos of the communities in which he practices. This makes the approach acceptable, accessible and appropriate for his clients.

FAMILY THERAPY IN AFRICA: BAKKER AND SNYDERS

In their practice of family therapy, Bakker and Snyders focus on the dominant discourses associated with Western approaches to family therapy, in which Western knowledge is revered over the local knowledge of healing practices. The authors situate this discussion based on the historical events in South Africa during the post-Apartheid era. The authors acknowledge dominance of Western healing practices, which sometimes are at odds with indigenous beliefs, norms and practices. Although therapists wish to help their clients the theories and models used hinder the ability to help local communities. They identify distrust the locals hold towards the previous colonizers. The use of counseling theories which keep the counselor as the expert, as perpetuates the myth that counselors are superior to their clients. On the other hand counselors try hard to connect with their clients but fail due to

the deep-seated distrust. The therapists feel they are in a no-man's land, and they have to identify ways of being more relevant in their work with indigenous clients.

Africanizing family therapy is a way to serve the interests of local communities through using theories that value local traditions and knowledge. This also incorporates the spirituality and political narratives of the local communities. Indigenous African knowledge is holistic, uniting empirical, rational and intuitive ways of knowing. The human being is part of the hierarchy of knowing that includes spirit beings, and is regarded as the primary determinant of human behavior (Mbiti, 1971). Human beings acquire knowledge through initiation and revelation. This shows that knowledge acquisition is not only rational and empirical, but also intuitive. Knowledge is transmitted through oral language, symbolism, ritual and art (Mbiti, 1971; Bellinger, 2013).

Traditionally, in African societies illness is viewed as a holistic occurrence. Physical illness is not considered as a list of signs and symptoms requiring a diagnosis and treatment. The traditional healers do not compartmentalize the problems clients bring. Instead, they consider the client holistically with physical, spiritual, relational and communal needs that need attention. For example, when a client goes to a traditional healer suffering from a physical ailment, the healer also asks about mental health (how is this affecting the client in that domain), spiritual health, family relational health, and relationships with the community. The client has a chance to talk about issues that may be troubling, get those off his or her chest; the client has a chance to explore other issues he or she might not have thought about that might contribute to the un-ease he or she is experiencing. Finally, the traditional healer might prescribe herbs, give suggestions or even offer further treatments to help the client. It is clear that the traditional healer serves the client in many roles: as supporter, healer and counselor (Mbiti, 1979).

Bakker and Snyders (1999) assert that to be effective family therapists in Africa, it is vital to privilege local knowledge and apply it to their work. To do this they use aspects of Narrative Therapy (White & Epston, 1990; White, 1995) to challenge the dominant discourses. They encourage privileging local healing traditions and practice in Africanizing family therapy so that it becomes relevant for working with Africans on the continent.

INDIGENOUS NARRATIVE THERAPY IN THE AFRICAN DIASPORA

The author has been using Narrative Therapy with diverse clients, supervisees and students in the Diaspora for several years. This therapy informs her work in helping individuals deal with their problems. When working with individuals of African descent, the author focuses on indigenous narrative therapy.

As stated earlier, Narrative Therapy helps clients to recognize dominant discourses that overshadow the strengths they have. Although individuals may not be first-generation immigrants in different parts of the world, they may be treated

as such due to phenotypes. Additionally, recent immigrants may stand out due to accents that may not be similar to those of the majority. These factors might reinforce dominant discourses of inferiority in abilities such as intellect and job performance. Sometimes these dominant discourses may be associated with being members of a stigmatized group. The author successfully used Narrative Therapy with a client of African descent, focusing on challenging the dominant discourse associated with being the family caregiver of her sister who was suffering from HIV/AIDS (Ngazimbi, Hagedorn & Shillingford, 2008). Individuals may carry these scars caused by dominant discourses, leading to living lower-quality lives.

INDIGENOUS NARRATIVE THERAPY FOCUSING ON CHALLENGING DOMINANT DISCOURSES

As stated earlier, dominant discourses seen as labeling can lead clients to live their lives according to the prescription of the discourse. Individuals in the Diaspora are looked at differently. Usually they have to work much harder to get the recognition similar to those from the majority. This leads to physical, emotional and mental health problems. There are problems of distrust between minority clients and therapists, as clients might feel that what happens outside the therapist's room might be enacted within the room, i.e., the notions of being treated differently and unfairly. This contributes to clients' noncompliance in relation to seeking and maintaining counseling relationships.

In working with clients of African descent, the author recognizes these similarities among them as a group: a) Their familiarity with story-telling traditions to encourage knowledge about their ancestors, encourage reflective thinking, link with their emotions, and education; b) Common values that are communalistic; c) Valuing families and relationships; and d) Individuals valued as being experts of their own lives. Based on those similarities, and the fact that most people of African descent face challenges in the Diaspora based on their heritage, the author uses these factors as background in her work.

CASE STUDY USING INDIGENOUS NARRATIVE THERAPY IN THE AFRICAN DIASPORA

X is a middle-aged man of African descent who migrated to the United States about 10 years ago. He enrolled at a university in a graduate program. Initially he was happy in his studies because he was of above average intelligence and had been a trained professional in his native country. He was likeable and he quickly established relationships with people in his church and also some peers in his graduate program.

I first worked with this client when he visited my office complaining of difficulty in sleeping, which made it difficult for him to stay awake during classes. Classes were held in the evening, after a day at work. In talking to him the author recognized that the client had other problems as well. He reported that he was having problems

connecting to other students. He believed that because he was different (age, nationality, accent) his peers perceived him as unintelligent. As a result, he felt others did not take his contributions seriously, whether in small groups or in the classroom. This was reinforced by one professor who indicated that the course material was too challenging for X.

X was very upset at this because he recognized that in spite of the fact that he had a break of 15 years since he was at school, his abilities were at par with those of 80th percentile of other students, based on graded assignments.

IDENTIFYING DOMINANT DISCOURSES

In working with X, I explained that as we enter the counseling relationship he needs to know that he will be the senior partner (expert of his life) and I will be the junior partner, facilitating his journey as he tells his initially problem-saturated story (White & Epston, 1990) to where he can hopefully tell his story from a position of empowerment. I encouraged him to tell his story. As I listened I identified times when he did not feel as lesser than his peers. At that point I looked for *sparkling moments* where he did not respond as he usually did. I asked him what it was within him that made him react differently. He stated: "I come from a heritage of kings. I have to remember that because of what other students think about people who look like me, they think I should behave like those people."

Counselor (CR): What is it that you would like your peers to see?

X: A strong person who can rise to challenges thrown their way. I know that each time I wake up I have many challenges waiting for me as soon as I leave the door

CR: How are these challenges affecting your life?

X: Each time I leave the apartment I have palpitations. I don't know what the next thing will happen that reminds me I am different

CR: How does this affect your relationships?

X: I have two children, aged eight and 10. I find that the way I think about myself has changed, especially since starting the graduate program. My self-concept is low. My children and my wife look up to me as father, husband and provider. It is difficult for me to rise to those expectations when I know that a lot of people look at me as amounting to nothing.

CR: That must be very difficult for you. How is this affecting your job?

X: I have more than one job. I hold two jobs—my main job is at a national grocery chain store, and my second job is at a residential facility for individuals with developmental disabilities. These jobs are demanding.

Because I am having problems sleeping, I am failing to be effective in them.

CR: If the situation remains the same, what do you think will happen in two weeks?

X: I think I might have to drop out of school, although that is the last thing I want to do. This is the only way out of poverty and getting out of the situation I am in

CR: If you were to name this problem, what would you name it?

X: Hardship.

The next time I met with X, I asked him about his relationship with Hardship in the past two weeks. He told me that he had found his way around him by speaking up more in class, and offering to do any technical aspects of group assignments. I asked him what it was about him that enabled him to step out of his comfort zone. He said it was determination to succeed. I asked him how that felt. He was pleased with himself, because he did not expect his peers to be so receptive to his efforts. These were sparkling moments when he behaved differently to how he used to. I told him this was cause for celebration. I asked him how he could experience similar feelings in the future. He told me he would continue to look for opportunities to make meaningful contributions in the future in class.

The author met with X for the fourth time. He reported that he was sleeping better, and that he felt more accepted in his classes. We explored what had changed. In the exploration I asked him if he could name the chapter during his first visit.

X: I would call it Darkness

CR: Why would you call it that?

X: Because when I first came there was no light in my life. Although I considered dropping out as a solution, it would not have solved the long-term problems I had. As I worked with you, things started to change

CR: How so?

X: I recognized that my peers and professor saw me through the stereotypes they knew about people like me. They did not see the real me. As I worked with you I realized that I had to figure out a way of getting them to see the real me

CR: During the middle part of counseling what would you have named the chapter of your story?

X: Progress

CR: Why would you have named it that?

X: There seemed to be progress in many areas of my life: I was sleeping better, I was less tired and had enough energy for my two jobs, my family, and school. My relationships with my peers improved.

CR: It looked like you did a great job of advocating for yourself in making changes. How were you able to do that?

X: As I looked at my life, I saw all the achievements I had made in my life: from a poor rural family, my parents were able to sacrifice and send me to school, and I graduated with a bachelor's degree from a university. I was the first graduate in my family. I remember how proud my family was of me. I went on to get a good job, and I helped my family financially. Now when I came to this country everything changed. Occasionally, I received help from others, and I was uncomfortable receiving the help. I started looking at myself as someone who had failed. It did not help that society had lower expectations of me. I suppose I internalized the dominant discourses, and I acted as expected.

CR: What changed?

X: As I worked with you and you told me I was an expert of my own life, at the beginning it did not ring true because I did not believe in myself anymore. As time went on, I started looking at myself as one having all these abilities that others were not aware of. I felt I had to let them know the real me. It felt like I finally found my voice!

DISCUSSION

This case study shows how the author worked with a client who initially had a problem-saturated story which changed over time as he slowly found the parts of him that lay buried under the dominant discourses. Through using deconstruction questioning (exploring the effect of the problem on the client's life, relationships, school and jobs), both the counselor and the client saw the effects, currently and across time. This facilitated the process of mapping the effects. The counselor facilitated the externalizing conversations through encouraging the client to name the problem. This helps the client to separate the problem, which may be fused with the client's identity. This externalization helps to regard the problem as an external object which both the client and counselor can tackle and overcome.

The success in overcoming the problem is shown when the client is able to sleep better, leaving him with energy to live his life better. The client's satisfaction with various aspects of his life also improved, including his family life, his work and his performance in his studies.

As the author worked with this client, the focus was on using story-telling, in line with African cultures. In African societies, individuals are considered as experts in their own lives as soon as they are old enough to help around the home. Although

young people respect and obey their elders, parents offer advice to young people to guide them, and well-bred youth usually utilize the advice. The idea of being an expert was appealing to X, as he did not like the idea of being told what to do by an expert. This approach also helped him to reclaim the person he knew before arriving in the host country.

In using this narrative therapy, the counselor used a familiar mode of communicating about the client's problem, which was non-threatening. X shared that he was very anxious about coming in for counseling as it was his first experience. He did not know what to expect. But he said that during the first meeting he started to relax as he realized that the approach was non-pathologizing, and that his issues were identified as problems, not as something needing a diagnosis.

X was able to explore the various facets of his problem. As he did so, he was able to see the relationships among the different facets, and also was able to see his strengths that lay inert. He was able to figure out what to try out to reduce the impact and size of the problem. Using the narrative approach, the counselor was able to use advantages of story-telling to the fullest. These include exploring the impact of the storyline to the protagonists, education about its impact, connecting the storyteller to his feelings, identifying strengths and using opportunities for change.

CONCLUSIONS AND IMPLICATIONS

Although Narrative Therapy originated in Australia and New Zealand, White and Epston acknowledge its emergence was based on Australian Aboriginal cultures which manifest a great deal of similarities with African culture. This situates its philosophy outside that of Western counseling theories, which conceptualize a person seeking help as having a deficit that needs to be fixed. Additionally, the client needs a diagnosis before he or she can get help. This is different in NT in that society is the genesis of problems individuals grapple with, and that the counselor enters the counseling relationship with the client to help the client change his or her relationship with the problem and re-write his or her story.

The author discusses Indigenous Narrative Therapy as practiced by practitioners from three different perspectives. This showed how narrative approaches can be used that have familiarity with parts of African cultures clients can relate to. As the world becomes a global village with the associated migration of people across continents, it is important to have available psychotherapeutic interventions that can be accessible, acceptable and appropriate for the diverse people therapists serve. Only then can therapists become more multi-culturally competent.

REFERENCES

Augusta-Scott, T., & Dankwort, J. (2002). Partner abuse: Lessons from education and narrative approaches. *Journal of Interpersonal Violence, 17*(7), 783–805. doi:10.1177/0886260502017007006

Bakker, T. M., & Snyders, F. J. A. (1999). The (hi)stories we live by: Power/knowledge and family therapy. *Contemporary Family Therapy, 21*(2), 133–154.

Behan, C. P. (2003). Some ground to stand on: Narrative supervision. *Journal of Systemic Therapies, 22*(4), 29–42.

Bellinger, J. A. (2013). Dancing through time and space, African dance and the Gewel tradition of Senegal at Suffolk University. *The Journal of Pan African Studies, 6*(5), 1–20.

Carlson, T. D. (1997). Using art in narrative therapy: Enhancing therapeutic possibilities. *The American Journal of Family Therapy, 25*(3), 271–283.

DiLollo, A., Neimeyer, R. A., & Manning, W. H. (2002). A personal construct of psychology view of relapse: Indications for a narrative therapy component to stuttering treatment. *Journal of Fluency Disorders, 27,* 19–42.

Jirata, T. J., & Simonsen, J. K. (2014). The roles of Oromo-speaking children in the storytelling tradition in Ethiopia. *Research in African Literatures, 45*(2), 135–149.

Lambie, G. W., & Milsom, A. (2010). A narrative approach to supporting students diagnosed with learning disabilities. *Journal of Counseling & Development, 88*(2), 186–203.

McLaren, J. (2009). African diaspora vernacular traditions and the dilemma of identity. *Research in African Literatures, 40*(1), 97–111.

Mbiti, J. S. (1971). *African religions and philosophy (Reprint)*. London, UK: Heinemann.

Monk, G., Winslade, J., Crockett, K., & Epston, D. (1997). *Narrative therapy in practice: The archeology of hope.* San Francisco, CA: Jossey-Bass.

Neal, J. H. (1996). Narrative therapy and supervision. *Journal of Systemic Therapies, 15*(1), 63–77.

Ngazimbi, E. E., Hagedorn, W. B., & Shillingford, M. A. (2008). Use of narrative therapy to support family caregivers of individuals diagnosed with HIV/AIDS. *Journal of Psychology in Africa, 18*(2), 317–324.

Ngazimbi, E. E., Lambie, G. W., & Shillingford, M. A. (2008). Using narrative therapy with clients diagnosed with bipolar disorder. *Journal of Creativity in Mental Health, 3*(2), 157–174.

Nwoye, A. (2006). A narrative approach to child and family therapy in Africa. *Contemporary Family Therapy, 28*(1), 1–23.

Petersen, S., Bull, C., Propst, O., Dettinger, S., & Detwiler, L. (2005). Narrative therapy to prevent illness-related stress disorder. *Journal of Counseling and Development, 83,* 41–47.

Semmler, P. L., & Williams, C. B. (2000). Narrative therapy: A storied context for multicultural counseling. *Journal of Multicultural Counseling & Development, 28*(1), 51–60.

Weber, M., Davis, K., & McPhie, L. (2006). Narrative therapy, eating disorders, and groups: Enhancing outcomes in rural NSW. *Australian Association of Social Workers.* doi:10:1080/031244070600985970

White, M. (1995). *Re-authoring lives: Interviews and essays*. Adelaide, Australia: Dulwich Centre.

White, M. (2007). *Maps of narrative practice.* New York, NY: W. W. Norton & Co.

White, M., & Epston, D. (1990). *Narrative means to therapeutic ends.* New York, NY: Norton.

Winslade, J., Crocket, K., & Monk, G. (1997). The therapeutic relationship. In G. Monk, J. Winslade, K. Crocket, & D. Epston (Eds.), *Narrative therapy in practice: The Archeology of hope* (pp. 53–81). San Francisco, CA: Jossey-Bass.

Wolter, J. A., DiLollo, A., & Apel, K. (2006). A narrative approach to counseling: A model of working with adolescents and adults with language-literacy deficits. *Language, Speech and Hearing Services in Schools, 37,* 168–177.

PART 5

METALLURGY

JAY SPAULDING

16. IRON METALLURGY IN ANCIENT SUDAN[1]

The recent historical resurrection of the pre-colonial Nubian-speaking communities of Kordofan invites reflection upon one of the activities for which, in their time, they were best known—the production of iron.[2] "Iron smelting is now a forgotten art in Northern Kordofan," wrote inquisitive colonial official Harold MacMichael at the dawn of the twentieth century.[3] Yet a contemporary Sudanese geographer remembered not only the north Kordofan Nubians themselves, but also the iron articles they had traditionally exported:

> The Nubian Mountains are located between Dongola and Kordofan. They are numerous, and among them are countless communities. The best-known is Jabal `Abd al-Hadi [one of the peaks of the hills now known collectively as Jabal Haraza], the capital of the Nubian Mountains. Its inhabitants are Nubians… There are places in the mountains specially dedicated to the manufacture of iron [articles], such as swords, lances, knives, axes, throwing-blades [trumbash], arrows and sickles. Mines of iron are found in their mountains.[4]

For reasons to be discussed below, the large ironworks at Jabal Haraza itself had probably stood idle for some time. However, as MacMichael noted, farther south, among the Jawama`a community in the vicinity of the precolonial Kordofan capital of Bara, iron "used to be worked so late as the middle of the nineteenth century."[5] In 1860, for example, Guillaume Lejean commented that "At Omzerzour I entered the metallurgical district of which the large village of Tendar is the center; this district contains numerous forges in the infancy of the art."[6] Ernst Marno offered this description in 1875:

> The inhabitants of this region are Jawama`a, and they obtain iron in primitive fashion from a brown ore found in the area. They erect conical furnaces about one meter in height from clay-like earth. The firing is accelerated by means of two bellows at the base; they consist of deep basin-shaped clay pots with a nozzle, over which a goat-skin is stretched loosely. The ore is mixed with charcoal of hashab wood [acacia verek] and poured into the furnace. The metal that gathers at the bottom is a rather impure product, which is reworked into malot [weeding-machetes], knives, lance-heads and the like. This refining of iron takes place only during the dry season of the year, for the furnaces must

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> dry out thoroughly for a long time before their use, which cannot take place during the rainy season.[7]

In 1838–1839, Ignatius Pallme offered a perspective that adds valuable insight into the ironworking vocation:

> The smiths are the most industrious workmen; they fabricate all the necessary household and agricultural implements, are at the same time miners, and smelters of ore; for they dig the iron from the bowels of the earth themselves, and melt it after a very simple process; but they do not understand how to harden it. They have no fixed workshops, but arrange them wheresoever they may happen to [p. 255] find work; the fitting up of the forge costs them but little trouble, for a large stone is soon found on which they place a piece of iron, this serves them as an anvil; close to this essential instrument, they construct a small furnace, to which a leather sack, answering the purpose of bellows, is attached. They make no heavy objects, for, beyond spear-heads, hashiash (an agricultural implement) [hoes, but also the small iron currency of Sinnar], double-edged and arrow-pointed knives of various sizes, they cannot produce any other article.[8]

The most extensive account of iron production among the Jawama`a was that of the Austrian mineralogist Joseph, Ritter von Russegger, who came to the Sudan as an expert in the service of the Egyptian viceroy Mehmet Ali and visited Kordofan in 1837.[9] The ancient Sudan is internationally famous among students of early Africa for its ironworking in Meroitic times.[10] Yet ironworking is not an aspect of historical tradition that modern Sudanese culture has chosen to remember and cherish. In part, this may be attributed to the absence of any conspicuous inventory of existing artifacts to be appreciated. This may partially be due to the ease with which metal could be repeatedly reworked as older iron objects became expendable and were reforged into new ones. Moreover, within the Nubian tradition of Kordofan, there existed a cultural rule that further inhibited casual neglect or discard of what might otherwise have become precious archaeological artifacts:

> A superstition prevails now that if the iron implements are allowed to lie on the land they will attract the strong north wind and the corn will be overwhelmed by the sand: in consequence they have diligently been collected and with due formalities stowed away by ‘fekis’ [Sudanese Arabic fuqara’, Islamic holy men] in deep fissures of the rocks [at Jabal Haraza]: it was here that I unearthed a lot of them, covered by stones.[11]

As the subsequent experience of rural folk resident northwest of Bara dramatically demonstrated, the threat of inundation by wind-borne sand was real enough.[12] When MacMichael searched the remains of the very ironworks visited by Russegger seventy-five years before, he found only a few overlooked fragments.[13] The meager tangible remains of pre-colonial ironworking, to be sure, are hardly sufficient to

generate much romantic cultural nostalgia. Yet it seems probable that the venerable tradition of Sudanese ironworking was not merely forgotten, but actively rejected. At least three important historical themes have contributed to the demise of indigenous Sudanese ironworking; two are familiar and predictable, but the third is new and potentially controversial.

COMPETITION FROM IRON IMPORTS

Sudanese ironworking, like many forms of African industrial and craft production, may in part have succumbed to competition from imported goods.[14] The late pre-colonial visitor John Lewis Burckhardt observed that sword blades were a conspicuous northern import in his generation; one of these may well be the weapon attributed to the late eighteenth-century Hamaj strongman Muhammad Abu Likaylik and now displayed in the National Museum in Khartoum.[15] While detailed analysis of iron imports during the Turkish period of Sudanese history is not at hand, even superficial impressionistic evidence may perhaps suffice to indicate that the trends of this age harmed, not relieved, Sudanese ironworking.

PROGRESSIVE DESERTIFICATION

Sudanese ironworking in Kordofan may also have suffered through a long process of progressive desertification that gradually removed the trees upon which the industry depended for fuel in the form of charcoal. Both changes in the climate and overexploitation by humans may have contributed. Unfortunately, this hypothesis would seem difficult to confirm. While the study of past environments in the Sudan has contributed significantly to scholarly understanding of very early times, few attempts have been made to bring forward comparable analyzes into historic days.[16] Studies based upon twentieth-century data might perhaps be projected backward to imply the presence of progressive desertification.[17] The result of such reasoning, however, remains speculative.

PRECOLONIAL POLITICAL ECONOMY AND CULTURE

Historians have often postulated a relationship between innovations in metallurgy and political, social and cultural development out of a remote prehistoric "stone age" into better-documented recent ages of bronze and iron. In regard to Africa, it could thus be said that "quite apart from the increase in productivity which the use of metals offers (and hence the possibility of maintaining a more complex administrative system), it is possible to supervise the technology itself, the weapons and the trade in weapons; some effective central control of force becomes feasible for the first time."[18] This interpretive insight, however, has not yet been properly applied to the post-Meroitic Sudan. For the medieval period, the impediment has been a tradition of scholarship grounded in Egyptology that found it difficult to expand its vision far

beyond the banks of the Nile; to the best of the author's knowledge, for example, no extant treatment of medieval Nubia includes a discussion of the ironworks of Jabal Haraza.[19] For the early modern age the problem has been the intellectual hegemony of an Orientalist reading of history that overemphasized 'tribes' and denied any significant role to central authority.[20]

IRONWORKING AND ETHNICITY: THE TUNJUR AND THE JAWAMA`A

Approach to a discussion of ethnicity and history in the North Sudan context requires some historiographical decisions. Twentieth-century Arabic-speaking communities of the northern Sudan, along with some of their Muslim neighbors who preserved a pre-Arabic rotana, often preferred to identify themselves as descendants of medieval immigrants from Arabia. In a biologically literal sense this is probably true, for if even one such immigrant existed (and few would doubt that), then by the laws of historical demography virtually every living Sudanese is his descendant. Whether or not any of the numerous surviving Arabic genealogical records accurately preserve memory of such a relationship is considerably less probable.[21]

There remains the question of whether the realities addressed by this genealogical endeavor possess historically explanatory power. The best answer is negative; although the genealogically-based approach to North Sudan history was defended and exploited thoroughly by earlier generations of Orientalist scholarship, in recent times it has been challenged and found seriously wanting.[22]

The history of Kordofan is particularly ill-served by this dominant historiographical tradition, for in comparison to the communities of the Nile Valley, those of Kordofan can offer only truncated genealogical records that even with every license of the imagination claim to address no age earlier than the period of Dar Fur rule during the later eighteenth and earlier nineteenth century.[23]

From the disciplinary perspective of history, as opposed to *Orientalism*, the ethnicities of North Sudan were shaped politically within the constraints of nature, technology and the prevailing system of political economy, notably mediated through the operation of institutions of land tenure.[24] The sequence of major political regimes in Kordofan therefore requires specification. In medieval times, though evidence is not as generous as would be desired, the communities of North Kordofan were apparently subject to the king of Makuria, most commonly visualized as resident in his riverine capital of Old Dongola.[25]

During the subsequent era of the Funj kingdom (c.1500–c.1800) the North Kordofan Nubian communities were subject in the first instance to the governor of the large northern province, whose capital lay at Qarri near the Nile confluence, while central Kordofan, along with western portions of the Nuba Mountains, formed a separate province of Kordofal with its capital at Bara.[26]

The period of Dar Fur hegemony in Kordofan (c. 1770–1820) and the age of Ottoman dominance to follow, brought about extensive ethnic reorganization.[27] The realities of this epoch may therefore not be projected uncritically backward into

earlier times. The twentieth-century North Sudan communities self-defined through Arab genealogy appear most commonly from an historian's perspective as the descendants of either a pre-colonial ruling house or a group of pre-colonial subjects. To choose examples from the Nile valley, the `Abdallab were the ruling house of the large northern province, and the Rubatab a community of their subjects.

It is important to avoid primordialism, for the fortunes of groups might well rise or decline with the vicissitudes of history. During the later eighteenth century the leaders of the Jamu`iyya rose from subject to elite status, only to fall back again within decades; the elite immigrant followers of Hashim of the Musabba`at were reduced to subject cultivators, and the conquering Turks threatened the Shaiqiyya nobility who resisted them with a similar fate. To return to Kordofan, the Sinnar provincial ruling house of Kordofal became a colonial Arab tribe called the Ghudiyat, while their subjects in the eastern ironworking environs of Bara became the Jawama`a.[28]

THE TUNJUR

The Tunjur of the twentieth century were a small, Arabic-speaking community of Dar Fur who considered themselves to be descendants of the followers of Abu Zayd al-Hilali, who had immigrated to the medieval Sudan from the northwest via the Maghrib.[29] Historically, the Tunjur have been seen as a ruling dynasty of Dar Fur, who supplanted an earlier Daju ruling house and annexed also the Chadian lands that would eventually become the kingdom of Wadai. Chronological estimates suggest that the Tunjur dynasty in Dar Fur came to an end near the beginning of the seventeenth century, with the rise of a new Fur-speaking dynasty, the Keira, and the birth of modern Dar Fur. One may therefore place the Tunjur in the sixteenth century and perhaps before. Alternative traditions have long suggested an eastern, Nubian origin for the Tunjur; however, late medieval Dongola was hardly more plausible than Tunis as a potential source for a conquering dynasty of Dar Fur and Wadai. But the rediscovery of the extensive Nubian-speaking community of pre-colonial North Kordofan invites a reconsideration of the alternative traditions, which specifically link the Tunjur dynasty not only to North Kordofan Nubian archaeological sites, but also to ironworking:

> Some Zagháwa from Dárfûr say the Tungur were once great workers in iron, and it may be that some of the old iron-workings, whose sites are still to be seen in Northern Kordofan, are traceable to the Tungur.[30]

This chapter would suggest that the same Tunjur kings who were reputed to have mobilized their subjects to level the tops of mountains in order to construct elaborate stone capitals such as `Ain Farah in northern Dar Fur, would also be plausible candidates for the organization of ironworking at Jabal Haraza (and perhaps elsewhere). The sixteenth century witnessed not only an age of Tunjur hegemony over Dar Fur and Wadai, but also the rise of the new Nile Valley kingdom of the Funj. The present author has argued that the Funj were southern Nubians from the

White Nile region.[31] This putative homeland may now wish to be extended westward into Nubian Kordofan.

The interpretation proposed here would ask for three revisions in the received tradition of historiography.

1. The most significant theme that marked the transitional age in North Sudan history from 1300 to 1500 was not an invasion of Arabs from Egypt, nor the decline of the medieval riverine kingdoms, but the rise of new Kordofan-based dynasties, the Tunjur in the west and the Funj in the east.
2. Upon reexamination, precolonial Kordofan does not appear to be peripheral to anything, but rather a womb of Nubian rulers.[32]
3. Since the ironworks excavated at Meroe seem in fact to be post-Meroitic in date, it may be possible to correlate the rise of Nubian-speakers to medieval prominence with an early efflorescence of the Kordofan iron industry.[33] The community that was to become the Jawama`a should be visualized as a participant in the ironworking organization of the kings who ruled Kordofan before the eighteenth-century incursions from the west of Fur-speaking Musabba`at and Keira.

THE JAWAMA`A

Before the Dar Fur incursions of the late eighteenth century, the ironworking zone introduced above formed a part of the Funj province of Kordofal, whose ruling house, the Ghudiat, was based at Bara.[34] No primary sources concerning ironworking in that place and age are known to the present writer. However, some tentative inferences may be drawn through comparison with other parts of the Funj kingdom.[35] The subjects were normally taxed in kind, and the subjects of southern districts were often taxed in the form of non-agricultural items that diverted attention from life-giving crops and livestock. It is known that subjects in gold-producing districts were forced through taxation policy to pan for gold; it would seem likely that the subjects in the iron-mining zone may have been similarly constrained to produce ore, and perhaps charcoal also.

Southern subjects were ruled through a system of "institutionalized insecurity" in which the threat of enslavement was the basic tool in the discipline of labor. Under these circumstances it is easy to imagine the gradual concentration of enslaved individuals in locations where less desirable activities such as mining were conducted. The special role probably played by a blacksmith caste has been postulated, but in the absence of evidence this theme may not be presently pursued. With the Dar Fur conquest the state role in iron production in Kordofan diminished, and without state organization and coercion, the industry gradually disappeared. By the twentieth century, it was only a rapidly-fading memory.[36]

NOTES

[1] This chapter is a modified, updated version of an article initially published as "The Ironworking of Ancient Sudan" in *Africa Update*. Vol. XV, Issue 4 (Fall 2008).

[2] Jay Spaulding, "Pastoralism, Slavery, Commerce, Culture and the Fate of the Nubians of Northern and Central Kordofan under Dar Fur Rule, c. 1750–c. 1850," International *Journal of African Historical Studies*. 39, 3 (2006), 393–412.

[3] H.A. MacMichael, *The Tribes of Northern and Central Kordofan* (Cambridge: Cambridge University Press, 1912), p. 60, note 1.

[4] National Records Office, Khartoum. Miscellaneous 1/15/182. Hadha kitab al-dar al-farid fi al-akhbar al-mufida al-muhtawi `ala mulakhkhas ta'rikh al-umma al-Nubiyya wa-jughrafiyat biladiha [wa-] asbab dukhul al-atrak min al-sultan Salim al-awwil wa-min Muhammad `Ali basha, wa-`ala Allah ahsan al-khitam. Amin. 4 Ramadan 1330/17 August 1912.

[5] MacMichael, Tribes, p. 243.

[6] Guillaume Lejean, Voyage aux deux Nils (Paris: Hachette, 1865), p. 41.

[7] Ernst Marno, Reise in der Egyptischen Aequatorial-Provinz und in Kordofan in den Jahren 1874–1876 (Wien: Hölder, 1879), p. 235.

[8] Ignatius Pallme, Travels in Kordofan (London: Madden, 1844), pp. 254–255.

[9] Joseph von Russegger, Reisen in Europa, Asien und Afrika. (Stuttgart: Schweitzerbart, 1841–1848.) The excerpt translated is from Volume 2, Part 2, Section 4, pp. 286–295.

[10] For example, see Peter Shinnie, *Meroe: A Civilization of the Sudan* (London: Thames & Hudson, 1967), William Y. Adams, *Nubia: Corridor to Africa* (Princeton: Princeton University Press, 1977), Derek Welsby, *The Kingdom of Kush: the Napatan and Meroitic Empires* (London: British Museum Press, 1996).

[11] MacMichael, Tribes, p. 91 note 2. The author has not yet been able to trace the subsequent fate of the artifacts recovered at Jabal Haraza by MacMichael.

[12] Leif O. Manger, The Sand Swallows our Land. (Bergen: Department of Social Anthropology, University of Bergen, 1981).

[13] MacMichael, Tribes, Appendix V "Objects found at Faragáb in middens," pp. 242–244. "Few iron objects were to be seen, but there was a plain rough iron ring, an inch in diameter, and two iron pins with dangling rings as shown in the accompanying illustration. These may have been used as hairpins or for applying 'kohl' [antimony] to the eyelids. There was little iron otherwise, save a few indeterminate scraps that had evidently been parts of the blades of spears or hoes. Iron is procurable in the immediate vicinity and used to be worked so late as the middle of the nineteenth century." (p. 243)

[14] The importance of this historical process to the continent as a whole was emphasized in Walter Rodney, *How Europe Underdeveloped Africa*, (London: Bogle-L'Overture Publications, 1972). The process was by no means unique to Africa; for northern North America see Harold Adam Innis, *The Fur Trade in Canada* (New Haven: Yale University Press, 1962). See a relevant discussion in Kathleen Smythe. *Africa's Past Our Future* (Bloomington: Indiana University Press, 2015) pp. 182–203.

[15] John Lewis Burckhardt, *Travels in Nubia* (London: J. Murray, 1819), pp. 303–304. For the sword of Abu Likaylik see Derek Welsby and Julie R. Anderson, eds., Sudan: *Ancient Treasures* (London: British Museum Press, 2004), PLATE 217, p. 245.

[16] For example, see David N. Edwards, "The Archaeology of Sudan," in Peter Gwynvay Hopkins, ed., *The Kenana Handbook of Sudan* (London: Kegan Paul, 2007), pp. 41–64.

[17] Two serious attempts to address the recent history of climate in the western Sudan may be found in Dennis Tully, Culture and Context in Sudan (Albany, NY: SUNY Press, 1989) and Alexander De Waal, *Famine that Kills* (New York: Oxford University Press, 1989). David Sterling Decker contributed a useful analysis of nineteenth-century conditions based upon the considerably more limited primary sources of that period in his 1990 Michigan State University PhD thesis, "Politics and Profits: The Development of Merchant Capitalism and its Impact on the Political Economy of Kordofan." All the authors cited believe in the progressive desertification of the region, though with somewhat different emphases, degrees of certainty, and sense of time-depth involved.

[18] Jack Goody, *Technology, Tradition and the State in Africa* (London: Oxford University Press, 1971), p. 46.

[19] Brief hints may be found in Jay Spaulding, "A Premise for Precolonial Nuba History," History in Africa XIV (1987), 369–374 and "Early Kordofan," in Michael Kevane and Endre Stiansen, eds., *Kordofan Invaded: Peripheral Incorporation and Social Transformation in Islamic Africa* (Leiden: Brill, 1998), pp. 46–59.

[20] An extended critique may be found in Lidwien Kapteijns and Jay Spaulding "The Orientalist Paradigm in the Historiography of the Late Precolonial Sudan," in Jay O'Brien and William Roseberry, eds., *Golden Ages, Dark Ages: Imagining the Past in Anthropology and History* (Berkeley and Los Angeles: University of California Press, 1991), pp. 139–151.

[21] For an extended discussion see Jay Spaulding, "The Chronology of Sudanese Arabic Genealogical Tradition," History in Africa, 27 (2000), 325–337.

[22] Kapteijns and Spaulding, "Orientalist Paradigm."

[23] For a discussion of the historical context see Spaulding, "Pastoralism, Slavery, Commerce, Culture."

[24] Lidwien Kapteijns and Jay Spaulding, "The Conceptualization of Land Tenure in the Precolonial Sudan: Evidence and Interpretation," in Donald Crummey, ed., *Land, Literacy and the State in Sudanic Africa* (Asmara: Red Sea Press, 2005), pp. 21–41.

[25] Spaulding, "Early Kordofan."

[26] Spaulding, "Premise."

[27] Spaulding, "Pastoralism, Slavery, Commerce, Culture."

[28] MacMichael, Tribes, p. 77; *A History of the Arabs in the Sudan* (Cambridge: Cambridge University Press, 1922), I, 224.

[29] MacMichael, Tribes, pp. 52–60. "The Tungur No Doubt Were at One Time a Great Tribe," he wrote, "though little is known of their history or whence they came" (p. 52).

[30] Ibid., p. 60, note 1.

[31] Jay Spaulding, "The Funj: A Reconsideration," *Journal of African History XIII*, 1 (1972), 39–54.

[32] Contrast the central theme of Kevane and Stiansen, *Kordofan Invaded*, which is sound analysis of colonial and post-colonial situations but is not a good guide to pre-colonial realities.

[33] Shinnie, "Meroitic Iron Working," p. 24. Shinnie believed that ironworking had been practiced on a small scale in the northern Sudan as early as the fifth or fourth centuries BCE (p. 21); however, the large works for which Meroe has enjoyed perhaps unjustified historiographical prominence seem to date from the sixth century CE, and are therefore more likely early Nubian than (extremely) late Meroitic.

[34] For the Funj rulers of Kordofal see Jay Spaulding and Muhammad Abu Salim, *Public Documents from Sinnar* (East Lansing, MI: Michigan State University Press, 1989), p. 385.

[35] For a discussion see Spaulding, *Heroic Age*, p. 4

[36] For decline in other areas, see Aribidesi Usman "Precolonial African iron metallurgy: Methodology, Socio-Cultural Context and Decline." In Toyin Falola and Maurice Amutabi,eds. *Perspectives on African environment, science and technology* (NJ: Africa World Press, 2012), pp. 17–44.

PATRICK DARLING

17. IRON-SMELTING IN NIGERIA

The region in and around today's Nigeria contains some of the highest concentrations of ancient iron-smelting in Africa (Gaucher, 1981; Darling, 1986; Okafor, 1993; Quéchon, 2000; Eze-Uzomaka, 2009; Clist 2013; de Barros, 1913). This chapter will use archaeo-metallurgical sites in today's Hausaland in northern Nigeria, with their associated dating, to suggest an overall framework for major developments of iron-smelting practices in Nigeria (Darling, 1983, 1984, 1985, 1986, 1989a, 1989b). The impact of this technology created the agricultural productivity, territoriality and settlement nucleation that underlie the construction of walls, kingdom boundaries and other earthworks noted in the second section. The chapter is based on my work for *The World of Iron* (Darling, 2013).

Earliest Phase: Between the second and third millennia BC, vertical slag-tapping furnaces with drip-pits began operating around the hard laterite-capped mesas (level low plateaux) of northern Nigeria. These lateritic or ironstone caps were a complex mix of indurated iron-oxides and clays from some of the world's earliest surviving land surfaces. Thousands of circular black-coloured slag blocks (or 'furnace-bottom' slags), some up to one-and-a-quarter metres in diameter and edged with one to two cm thick 'walls' of baked clay, fringed the mesas or low plateaux in semi-continuous clusters. There was little evidence of any tuyères, sherds, slag heaps or additional slag fragments: almost all the slag found was in the intact drip-pits – there were only a few visible fragments of slag from upper furnace structures or broken drip-pits. Single drip-pits, drip-pits divided by an internal baulk, and multiple mini drip-pits exhibit structural variations that would seem to indicate a degree of technical experimentation, possibly in response to material or cultural constraints.

At the time of survey, 'furnace-bottoms' were thought to be remains of 'bowl furnaces' (Sutton, 1982). However, a gully-side exposure near Sokoto, showed that 'furnace-bottoms' were drip-pits lying underneath, but offset from, slightly thicker clay-lined furnace superstructures. In this case, the furnace superstructure was too weak to exist without being embedded in the gully-side and it collapsed soon afterward. It seems likely that a vertical pit was dug and lined with clay in the higher ground close to the gully; then the underlying drip-pit was dug into the lower ground created by the gully, below the bluff, hence the slight offset. Many drip-pit ruins were not in gullies but ran parallel to the mesa. Their associated vertical slag-tapping furnace superstructures would have needed vertical bluffs about two metres high. In this region's peneplain, natural bluffs occur only along mesa scarp faces and hillside

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gullies, where past loess dune mantles provide a homogenous, cohesive medium. Each year, it is posited, bloom extraction destroyed the past season's superstructures and the rubble and loosened soil had to be removed to create the next season's batch of furnaces, leaving only the underground drip-pits or furnace bottoms intact. This process worked back the bluff and left the older drip-pits further from today's mesa scarp faces than later furnace bottoms. On this assumption, at one site near Roni, artificial scarp erosion during the smelting era averaged eleven metres, nearly twice the mean natural backward erosion over the subsequent two millennia.

Firewood and charcoal were too bulky to transport far, so were another important location determinant for iron-smelting sites. It seems likely that the trees used to make charcoal were more abundant than today and that the favoured *kirya* species (*Prosopis africana*) was largely obliterated from the area by intense past smelting activity, along with the last vestiges of loess soils atop the mesas—as indicated by a cluster of 130 furnace-bottoms atop a mesa near Roni.

Early Phase Dating: Three thermoluminescence dates obtained from Durham University for slag-pit furnaces were based on sub-surface fired-clay samples and their adjacent background soil: they ranged over 2,400 ± 1,100 BC, 1,400 ± 850 BC and 380 ± 320 AD from Fitola, Matanfada and Roni, respectively (Darling, 1983, 1984, 2013: 158–159). Iron-smelting was supposed to reach the Sahel in around 500 BC (Killick et al., 1988), but the Fitola and Matanfada dates were around one to two thousand years earlier. Furthermore, the 2,400 BC date from Fitola was contemporaneous with some of the world's earliest iron-smelting, then believed to emanate from the Middle East. In the early-mid 1980s, therefore, the early Fitola and Matanfada dates were chronologically and geographically isolated. Durham laboratory checked the internal dose rate and the reliability of the background count but found no anomaly. Yet the reliability of TL dating of near-surface material, the high standard error of these dates, and the highly unusual presence of tuyères at Fitola underlay other queries, which needed to be addressed by a new set of collected material. However unsatisfactory, these 1983–1984 dates were the earliest hint that some of the world's earliest iron-smelting was found in West Africa.

The perceived isolation of these dates was temporary. Iron-slag was noted at all levels at a Birnin Kudu rock-shelter excavation (Fagg A. Pers. Comm., 1986) and a Nok radiocarbon date of 925 ± 70 BC (Rustad, 1980) led to some reconsideration of Killick et al.'s 500 BC date, as the Nok culture extended much further north than originally supposed. In the wider West African region, second to third millennia BC dates were obtained for fired structures in eastern Niger by Grébénart, even though they were later dismissed as the result of 'old' charcoal or copper smelting. Over a decade later, more dates were obtained from eastern Niger – 2,600 ± 300 BC and 2,098 ± 423 BC (Quéchon, 1999): this time they were based on sherds having a proximal association with iron-smelting remains.

This stirred up discussion about West Africa possibly having the earliest dates for iron-production in the world (McIntosh, 1999; Sopova, 2002; Aremu, 2003; Alpern, 2005), but this discussion failed to note the previously published corroboratory dates

from Fitola and Matafada (Darling, 1983, 1984, 1985, 1986, 1987a, 1987b, 1989a). When the Nigerian and Niger evidence are combined, it strengthens the case that some of the world's earliest iron-smelting may have come from this region.

Iron was first noted in 2,900 to 2,700-year-old Middle Eastern texts (McNutt, 1983), but this was probably confined to rare meteoritic iron with a significant nickel content, as exemplified by the 2,300 to 2,500-year-old Alachöyük dagger. More abundant terrestrial iron is conventionally held to have began being smelted in the Middle East and the Anatolian Peninsular about 2,500 years ago, with carburisation processes dating to 2,200–2,000 years BP (Walbaum, 1980). The Niger and northern Nigerian dates are on a par with, or even earlier than, the Anatolian dates, so deserve more academic attention.

Late Phase: Horizontal **s**lag-tapping furnaces with their characteristic large slag-heaps, tuyère fragments and much thicker (5–15cm), shaft furnace walls appeared here between a 380 ± 320 AD vertical slag-tapping drip-pit furnace near Roni and the mid-late first millennium AD slag-tapping furnace dates reported for Dala hill in Kano, Samaru West near Zaria, the Kabba-Okene area and Igboland (Rackham, 1972; Sutton, 1982; Obayemi, 1993; Darling, 1983; Okafor, 1993). The chimney shafts were removable to allow multiple smelts, so their incidence was correspondingly lower than for the vertical slag-tapping drip-pit furnaces. Smelting had shifted to the nearby Kazaure quartzite ridges to use charcoal made from the hard red wood of the *kirya* (*Prosopis africana*): fuel, not bluffs or ore, was now the locating factor (Darling, 1986).

Late Phase Dating: The vast majority of horizontal slag-tapping furnaces were slightly tapering shaft furnaces with radial tuyère(s) such as the one found exposed in a borrow-pit near Kazaure reservoir, which produced an uncalibrated radiocarbon date of 580 ± 70 ad (814–989 AD on Clarke's calibration curve). Three Thermoluminescene dates of 720 AD ± 250 (DurTL 57-6AS), 830 AD ± 230 (DurTL 57-7AS) and 1140 AD ± 170 (DurTL 57-4AS) were obtained for such shaft furnaces in the Kazaure Hills (Darling, 2013).

This variety of furnace typologies indicates some experimentation during the late first millennium AD. Whether this reflects the practices of different smelting groups evolving different cultural typologies over time, or whether it was a response to different types of ore or some other technical factor is not known. At present, interpretation leans towards the first explanation; for the slag products are very similar from whatever type of furnace is used (Rehren et al*.,* n.d.; 212). Furnaces with single, large, vertical tuyères incorporated into the furnace structure were rare. Similar down-draught furnaces re-enacted at Mafa in North Cameroon produced cast iron, steel and low-carbon iron (David, 1989). Some tuyères penetrated the basal slag and furnace wall like those observed in Tanzania, where tuyères full of kaolin were placed vertically in the bottom of furnaces for ritual purposes before the smelt (Schmidt & Mapuda's 1997, pp. 98–99).

The difference in smelting efficiency between vertical slag-tapping furnaces with drip pits and horizontal slag-tapping furnaces depended on finding past ore

sources. Local informants helped to identify recent ore sources in various parts of Nigeria. XRF (X-Ray Flourescence) analyzes, based on pulverised ores set in resin, were analyzed at Southampton University. They produced a series of graphs with pronounced peaks easily identifying magnetite ores in Yorubaland; hard grey haematite ore (soft brown where weathered) for the C12th A.D., natural-draught smelting furnaces using numerous short narrow tuyères at Itakpe near Lokoja; a limonite component in the majority of ores; and a friable golden brown goethite ore from the Makurdi Hills near Bakori.

Bakori informants claimed that this last goethite ore had been mined for centuries (Keen, 2006), creating over two hundred shaft mines along parts of the Makurdi hills near Bakori. The shafts, each *c.*90cm in diameter and about five metres apart, lay between two north-south parallel quartzite ridges roughly fifteen metres apart. Weighted-tape measurements indicated an undulating enriched layer of past ore exploitation eight to fourteen metres underground. Lowering a lighted kerosene lamp, no scorpions, snakes, collapse, carbon dioxide or methane could be detected, although disturbed bats flew out of an adjacent shaft. A perilous belay down one shaft to collect an ore sample avoided touching the shaft walls. At the base, horizontal mining extended to create a dangerously large underground cavern linked to two other shafts (so explaining the disturbed bats): here, a sample of friable, golden-brown ore was collected. During the ascent back up, it was necessary to use the old handholds and footholds, causing sections of the shaft wall to give way with loud thumps as they hit the bottom.

Other shaft mines in Nigeria were observed near Tureta, a past steel sword-making centre in the C19th and possibly much earlier (Duffil, 1984); there are shafts still being sunk by gold-diggers near Birnin Gwari and near Ilesha; and the thousands of edible clay mines noted in the previous section where, it is suggested, women accidentally discovered iron-smelting—a possibility that twists the gender issues raised by Herbert (1993), Berns (1993) and Maclean (1998) and takes their arguments a step further.

Major Elements Analyzes: In northern Hausaland, the quest to discover early phase iron ore sources was challenging. Major elements analyzes of uncorroded slags and potential ores indicated that the mesa or plateaux laterites probably used for large-scale smelting had lower iron-oxide contents than the local slag. The ancient ore has, therefore, not been precisely located. Nevertheless, using all ten major elements from analyzes undertaken at Southampton University, Roni slag and laterite were closely correlated, indicating that the ore still had a local origin; but the high level of phosphorous in Roni slag and laterites might have seriously impaired product quality in terms of brittleness.

The lack of ancient ores and the small sample size inhibit full comparison of vertical and horizontal slag-tapping furnaces conversion efficiency but they do not preclude it. The mean iron content percentages of drip-pit slags (from early vertical slag-tapping furnaces) had a mean iron content of nearly fifty percent, whereas tapped slag (from later horizontal slag-tapping furnaces) contained about

forty percent. Assuming, *pro tem*, similar ores, this difference would represent an appreciable increase in the extraction of iron. One interpretation of this could be that early iron-age vertical slag-tapping furnaces with drip-pits were less efficient than late iron-age horizontal slag-tapping furnaces. Indeed, Okafor (1993) attributes similar changes in Igboland smelting byproducts to this technical shift.

Yet the numerous mine shafts testify that the Makurdi ores were clearly regarded as being high grade. This may well have involved perceptions concerned with self-fluxing properties and rates of smelting success rather than with percentage of iron extracted or phosphorus content. Over time, the discovery of improved ore sources in terms of smelting success (which is what the rituals sought to enhance) may provide a better explanation for any productivity increase than technology *per se*. Without many more samples being analyzed, though, one cannot press this small data set too far for other viable interpretations. Whatever the exact cause, it is possible that a surge in late iron-age productivity was one key factor in the changes in wealth, trade and state-formation involved in the creation of, *inter-alia*, Old Ghana, Kanem-Borno and early Hausaland.

It is impossible to examine directly the subtleties of 'migration' and 'diffusion' in the advent of late iron-age techniques over a thousand years ago. Insights provided by ethnoarchaeology or participatory observation were unobtainable because iron-smelting in this region died out about sixty years previously. The best proxy solution was to interview old farmer-blacksmiths with boyhood memories of iron-smelting, even though they lived and farmed (now, as then) far from where they smelted. During their youth in the early- 20th century, they recalled that iron-smelting was a dry-season *cinrani* activity—a seasonal coping mechanism inducing a consumption time-lag to conserve vital food stores for the prolonged 'hungry season' energy demands by both farmers and smiths (Darling, 1987b). The key to *cinrani* calculations lay in the sealing of granaries, leaving a generous *mudu* of grain per person per day for those remaining (Mortimore, 1989).

By the early 20th century, farmer-blacksmiths of the fertile Kano plains were journeying mainly east and west to whichever was the nearest smelting location to create numerous, great, *matamaci* (seasonal encampments) of one to five hundred *bukka*, temporary houses, around each dry season's smelting activities. The site of each *matamaci* shifted every year to exploit new trees for charcoal-making (Darling, 1987), whereas the best sites for the exploitation of iron ore lasted for decades or centuries (Keen, 2006). As the *matamaci* were sited in the no-man's-lands between powerful political entities, they acted as large seasonal markets, enabling the farmer-blacksmiths to create extra wealth from the sale of smelted blooms and to meet current expenses from smithing. The Maguzawa, Siri, Kare-Kare and other non-Muslim farmer/smelters tended to reside more permanently in these no-man's-lands (Last, 1993; Darling, 2004).

In this process of exchange between smelters from different regions, the merits and demerits of different local ores, charcoal and smelting practices were discussed, so diffusing a wide variety of experimental smelting techniques. Eye-witnesses

in the 1980s recollected a whole range of early-C20th techniques over and above the single standard Hausa technique recorded (Pole, 1975; Sutton, 1976a; Jagger, 1973). Similar variations reported by Killick (1988) also indicate such diffusion and knowledge sharing. This seems to be at odds with traditions that each family's smelting secrets were retained down the generations, as such secrets would seriously constrain any technical diffusion.

A curious spiked bowl probably once used for magical potions (Schmidt & Mapunda, 1997, pp. 87–90, 95) may solve this enigma. Smelting was a risky business, so special herbs used in night-time rituals before every stage of the smelting process were perceived to make the crucial difference between success and failure (Herbert, 1993; Keen, 2008); so these herbs and magical rituals were probably what each family kept secret – not the practical experimentation that was part of everyday pooled knowledge (Darling, 2004, pp. 106–107). These magical secrets, playing with fire and fire-walking (Madauci et al., 1968) became part of the mystique and socio-political identity of the non-Muslim Maguzawa. Their 'identity rejection' of growing Hausa religious and political dictates was permitted by early Muslim traders because their ancient practices meant that they could be considered '*Magians*' – not "pagan" *arna*.

At Siri, a ban on iron-smelting during the 19th century Jihad led to a different kind of secrecy. Donkeys were used on covert night-time journeys to collect iron-ore along the Bunga river; then this was smelted at night inside hill-top houses where the furnace faced away from the door lest its glow betray the forbidden construction of tools and weapons for the renegade Ningi. Similarly, the secrets held by all blacksmiths/smelters were to give them a special identity, often independent from the rest of society (De Barros, 2000, p. 175).

The main tools forged were the triangular *fartagnya* and wide-tined *galma/garma*—the different types of hoe used respectively for strong clayey and loose sandy soils; and the dyadic role of farmer-blacksmiths led to efficient, appropriate development of this agricultural technology.

Gender, ritual and symbolism were vital facets of past African iron production (Saltman, 1986, p. 8; Herbert, 1993; Schmidt & Mapunda, 1997; Katz Hyman & Rice, 2011). However, it was the technical efficiencies of sharp, durable iron tools that actually achieved change. Land clearance, cultivation, house construction, well-digging, firewood collection and a host of other activities encouraged increasingly sophisticated levels of management, which later supported permanent agriculture using *taki* (manure) in a densely populated 'close-settled zone,' the largest trading emporium in West Africa at Kano City, and the largest concentration of walled urban settlements in Africa (Mortimore & Wilson, 1965). As soon as the increased productivity of the late iron-age farmer-blacksmiths became apparent, elitist religious, political, military and commercial power groups vied with one another to control or to tax iron supplies and to expropriate the surplus rural wealth into more urban centres (Darling, 1987). Here, the same blacksmiths, who beat out the hoes creating the agricultural prosperity of Hausaland, now also beat out the swords,

spearheads and fetters that underpinned the state control needed to create and sustain its increasingly urban identity (Jaggar, 1973).

Omoweh argues that iron-smelting in Nigeria collapsed because "*the colonial state deliberately prohibited any form of manufacturing from taking place in Nigeria*" (2005, p. 57), thus enabling companies like the United Africa Company to import hoes, steel pipes, rods and coils with little competition (Omoweh, 2005, pp. 58–59). Some would argue that taxation played a greater role than 'prohibition' but the iron-smelters themselves claimed that they gave up smelting because broken lorry springs were a more easily accessible source of good steel. The technologies of iron-smelting and earthwork construction never existed in isolation: they expressed needs and priorities. Iron-smelting was a huge long-term catalyst for change whilst earthworks sought to maintain order by protecting societies from the more traumatic expressions of such change.

The collapse in traditional smelting was the end of an era, for its farmer-blacksmiths terminated their engagement with the ritual and practical activities developed by the first smelters, whose experimental playing with fire, over three-and-a-half millennia ago, had probably ushered in a major new technology to the rest of the world.

The earliest iron-smelting predates the known Arab trading records and, if the Diaima mound evidence is complete, it evaded the civilizations around Lake Chad. However, it was soon evident in Igboland and other parts of the world. Whether or not iron-smelting originated in northern Nigeria/southern Niger is open to question pending further dating but it does compete for that elusive accolade. Its distinctive early slag-pit technology required considerable effort for each smelt on a new site, whereas the later phase slag-tapping technology was able to undertake about a hundred and fifty smelts on the same site slag-heap (Hooper). Over the last one-and-a-half millennia, the slag-tapping technology of the late iron age took over much of the world. The hundreds of dome furnaces in Yorubaland (Adeniji), the near intact shaft furnaces in Yankari Game Reserve and the more ruinous Kazaure Hills shaft furnaces noted above are some of the better preserved examples of a technology that dramatically affected farming, urbanisation and warfare—all of which are related to earthwork constructions to demarcate community farmlands and kingdoms and to defend settlements, particularly during the unsettled times of the C19th *jihad*.

REFERENCES

Adéníji, D. A. A. (1977). *Isé ìrin wíwà àti sísun ní ìlèe Yorùbá. Iron mining and smelting in Yorubaland.* Institute of African Studies Occasional Publication 31, University of Ibadan.

Alpern, S. B. (2005). Did they or didn't they invent it? Iron in sub-Saharan Africa. *History in Africa, 32*, 41–94.

Barth, H. (1857). *Travels and discoveries in north and central Africa*. London: Ward Locke & Co. (1890).

Connah, G. E. C. (1985). Agricultural intensification and sedentism in the *firki* of NE Nigeria. In S. Farrington (Ed.), *Prehistoric intensive agriculture in the tropics, part ii* (pp. 765–785). Oxford: BAR International Series 232.

Darling, P. J. (1983a). Iron-smelting in the Kazaure Hills. *Zaria Archaeological Papers, V*, 40–41.
Darling, P. J. (1983b). *Iron-smelting in Hausaland, northern Nigeria.* Pan-African Congress on Pre-History and Related Studies, Jos, Nigeria.
Darling, P. J. (1984). Report on archaeological activities at Bayero University, Kano. *Zaria Archaeological Papers, VI*, 24–27.
Darling, P. J. (1985, May 7). The coming of iron to Kano. *The Triumph Newspaper, Kano*.
Darling, P. J. (1986). Fieldwork surveys in and around Kano State, Nigeria. *Nyame Akuma, 27*, 39–41.
Darling, P. J. (1987a). *The splendours and miseries of technical change in agriculture*. Winegarten Essay Prize, National Farmers' Union/Wye College, Kent.
Darling, P. J. (1987b). *Seasonal food strategies and coping mechanisms of blacksmiths and smelters in Hausaland, northern Nigeria: Some implications for development studies.* Unpublished paper for Conference on The Changing Sahara, Wye College, Kent.
Darling, P. J. (1989a). Archaeology and the dating of historical events in Kano. In B. M. Barkindo (Ed.), *Kano and some of her neighbours*. Kano: Department of History, Bayero University .
Darling, P. J. (1989b). How cattle, iron, sorghum and irrigation influenced social and agricultural development in Hausaland. *Nigerian Field, 54*, 11–18.
Darling, P. J. (2004). Migrants, millenialists and mayhem: Kari-Kari, Ningi, Gwari, Kebbi, Kwatarkwashi and Zuru 'enclaves' in northern Nigeria. In L. Smith, P. Rose, & S. Wahida (Eds.), *Fifty years in the archaeology of Africa. Themes in archaeology and practice. Papers in honour of John Alexander. Azania* (Special volume XXXIX). Nairobi: BIEA.
Darling, P. J. (2009). *The visible archaeology of Hausaland: sherds, stones, slag, shrines, words, walls and baobab tree dating*. PowerPoint presentation and paper for *Conference on Hausa Identity*. UEA & Liverpool.
Darling, P. J. (2011). August–September 2011 Fieldwork Notes. *African Legacy.*
Darling, P. J. (2013). The world's earliest iron-smelting? Its inception, evolution and impact in northern Nigeria. In J. Humphris & T. Rehren (Eds.), *The world of iron.* London: Archetype Publications.
David, N. (1988). The ethnoarchaeology and field archaeology of grinding at Sukur, Adamawa State, Nigeria. *African Archaeology Review, 15*(1), 13–63.
David, N., Heimann, R., Killick D., & Wayman M. (1989). Between bloomery and blast furnace: Mafa iron-smelting technology in North Cameroon. *African Archaeological Review, 7*(1), 183–208.
De Barros, P. (2000). Iron metallurgy: Sociocultural context. In M. S. Bisson, S. T. Childs, P. De Barros, & A. F. C. Holl (Eds.), *Ancient African metallurgy: The sociocultural context.* Lanham, MD: AltaMira Press.
Duffil, M. (1984). Pers. Comm.
Eze-Uzomaka, P. (2009). Iron and its influence on the prehistoric site of Lejja. In *The world of iron.* London: Archetype Publications.
Fagg, A. (1972a). Pottery from the Rop Rock Shelter Excavations of 1944 and 1964. *West African Journal of Archaeology, 2*, 20–38.
Fagg, A. (1972b). A preliminary report on an occupation site in the Nok Valley, Nigeria. *West African Journal of Archaeology, 2*, 75–79.
Fagg, A. (1986). Pers. Comm.
Goucher, C. (1981). Iron is iron 'til it is rust: trade and ecology in the decline of West African iron-smelting. *Journal of African History, 22*, 178–189.
Herbert, E. W. (1993). *Iron, gender and power – Rituals of transformation in African societies.* Bloomington, IN: Indiana University Press.
Jaggar, P. (1973). Kano City Blacksmiths: Pre-colonial distribution, structure and organization. *Review of African Political Economy, 13*, 21–36.
Jaggar, P. (1973). A Kano blacksmith's vocabulary. *Kano Studies*, *1*, 99–110.
Keen, J. (2006). Pers. Comm. (worldwide iron-smelting observer: saw Nigerian sites).
Killick, D., Van der Merwe, N. J., Gordon, R. B., & Grebenart, D. (1988). Reassessment of the evidence for early metallurgy in Niger, West Africa. *Journal of Archaeological Science, 15*(4), 367–394.
Kratz-Hyman, M. B., & Rice, K. S. (2011). *World of a slave: Encyclopaedia of the material life of slaves in the United States.* Westport, CT: Greenwood.

Last, M. (1993). History as religion: De-constructing the Magians ("Maguzawa") of Nigerian Hausaland. In J.-P. Chrétien (Ed.), *L'invention religieuse en Afrique: historie et relgion en Afrique noire.* Paris: Karthala.

Maclean, R. (1998). Gendered technologies and activities in the Interlacustrine early iron age. In S. Kent (Ed.), *Gender in African prehistory*. Walnut Creek, CA: Atta Mira Press.

Madauchi, I., Isa, Y., & Daura, B. (1968). *Hausa customs*. Zaria: Northern Nigerian Publishing Company.

Magnavita, C., & Magnavita, S. (2001). New evidence of proto-urban settlements in the Lake Chad area. *Nyame Akuma, 55*, 46–50.

Magnavita, C., & Magnavita, S. (2002). Recent finds of domesticated *Sorghum bicolour* in the Lake Chad region. *Nyame Akuma, 57*, 14–20.

McIntosh, R. (1999). Africa's storied past. *Archaeological Institute of America, 52*(3), 54–60.

McNutt, P. (1983). *Inquiry into the significance of iron technology in early Iron Age Palestine* (Unpublished thesis). University of Montana, Missoula, MT.

Meek, C. K. (1925). *The northern tribes of Nigeria*. Oxford: Oxford University Press.

Mortimore, M., & Wilson, J. (1965). *Land and people in the Kano close-settled zone: A survey of some aspects of rural economy in the Ungogo District, Kano Province* (Occasional Paper 1). Department of Geography, Ahmadu Bello University, Zaria.

Mortimore, M. (1989). *Adapting to drought: Farmers, famines & desertification in West Africa.* Cambridge: Cambridge University Press.

Nakai, I., Abe, Y., Tantakarn, K., Omura, S., Erkut, S. (n.d). Preliminary report of the analysis of an early bronze age iron dagger excavated from Alachoyuk. *AAS, 17*(1), 321–324.

Okafor, E. E. (1993). New Evidence on early iron-smelting from Southeastern Nigeria. In T. Shaw, P. Sinclair, B. Andah, & A. Okpoko (Eds.), *The archaeology of Africa: Foods, metals and towns* (pp. 432–448). One World Archaeology Series (P. J. Ucko, Ed.). New York, NY: Routledge.

Omoweh, D. A. (2005). *Political economy of steel development in Nigeria: Lessons from South Korea.* Trenton, NJ: Africa World Press, Inc.

Pole, L. M. (1975). Iron-working apparatus and techniques: Upper regions of Ghana. *West African Journal of Archaeology, 5*, 11–39.

Phillips, J. E. (1989). A history of the Hausa language. In B. M. Barkindo (Ed.), *Kano and some of her neighbours*. Kano: Ahmadu Bello University Press, Department of History, Bayero University.

Rehren, T., Charlton, M., Chivikure, S., Humphris, J., Ige, A., & Veldhuijzen, H. A. (n.d.) *Decisions set in slag; the human factor/ARC in African iron-smelting.* Retrieved from www.Ironsmelting.net/www/smelting-MetMines-Rehren.pdf

Rustad, J. A. (1980). The emergence of iron technology in West Africa, with special emphasis on the Nok culture of Nigeria. In B. K. Swartz & R. E. Dumett (Eds.), *West African cultural dynamics: Archaeological and historical perspectives* (pp. 227–246). The Hague, The Netherlands: Mouton.

Saltman, C. (1986). *The blooms of Banjeli: Technology and gender in West Africa.* Documentary Education Resources (Film and Study Guide).

Schmidt, P. R., & Mapuda, B. B. (1997). Ideology and the archaeological record in Africa: Interpreting symbolism in iron smelting technology. *Journal of Anthropological Archaeology, 16*, 75–102.

Quéchon, G. (2000). Les datations de la métallurgie du fer à Termit (Niger): leur fiabilité, leur signification. In Bacoum (Ed.), *Aux origins de la métallurgie du fer en Afrique: une ancienneté méconnue*. Paris.

Rogers, P. A. (1990). *The regional dynamics of Hausa iron-working: A social history of technological adaptation in nineteenth-century northern Nigeria* (Dissertation Research Proposal). Department of History, Univeresty of Wisconsin-Madison, WI.

Shaw, T. (1978). *The archaeology of Nigeria.* London: Thames & Hudson.

Sopova, J. (2002). *Iron in Africa – Revisiting the history.* Geneva: UNESCO.

Sutton, J. E. G. (1976a). Iron working around Zaria. *Zaria Archaeological Papers, 8*.

Tylecote, R. (1975). The origins of iron-smelting in Africa. *West African Journal of Archaeology, 5*, 1–10.

Usman, M. (1990, October 28–31). *Kazaure iron smelting*. Paper for Workshop on Archaeology and Metallurgy, ABU Zaria (*Akodi Afrika*, Iffe Ijumu, Kogi State, paper 901).

Waldbaum, J. C. (1980). The first archaeological appearance of iron and the transition to the iron age. In T. A. Wertine & J. D. Muhly (Eds.), *The coming of the age of iron*. New Haven, CT: Yale University.

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