

Nature as Instrument: The Origins and Sound Imitation of African Traditional Instruments

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Abstract

This paper centers on three African traditional instruments, namely the water drum, ocean drum, and raintick, examining their emulation of natural sounds, origins and cultures. By taking an interdisciplinary approach and combining the fields of ethnomusicology, anthropology, and ecomusicology, the structural, acoustic, and manufacturing features of these instruments are analyzed. The study concludes that they are able to successfully reproduce natural sounds like the flow of water, ocean waves and rainfall by utilizing natural materials or mechanical simulation directly. Beyond their ritual functions within African communities, such as rain cultivation rituals, sacrificial ceremonies and agricultural practices, these instruments are examples of the deep relationship between human musical expression and the natural environment and as such, they subvert traditional western conceptions of music. Cross- and cross-national comparisons show that imitating natural sounds is a universal component of world musical practices, but African musical instruments with their specific practicality and cultural attachment reflect music's essential function as a bridge between human beings and nature and can provide useful insights into sustainable musical practices and improved cross-national communication.

Keywords

Traditional African Instruments; Natural Sound Imitation; Cultural Functions; Ecomusicology.

1. Introduction

Is music a human invention or part of nature? This question has puzzled scholars for hundreds of years, and everyone has been thinking about the nature and origin of music. The line between natural sounds and artificial music is blurred-especially instruments that mimic nature. This paper explores this boundary through traditional African instruments (water drum, ocean drum, raintick), as they draw inspiration directly from natural sounds.

The African musical tradition is an ideal case for studying the relationship between music and nature. As Udofia [1] said: "Playing African instruments depends on the occasion. To truly understand these instruments, you must first understand the culture and living environment behind them "(p. 199)-including how nature affects the material and sound of the instrument. Water drums use membranes filled with water to create flowing tones; ocean drums use beads or stones inside to imitate the rhythm of waves; raintick reproduces the rustle of rain through the flow of internal materials. These instruments demonstrate how Africans turn natural sounds into playable music, not just symbolically imitating nature, but to truly reproduce natural sound phenomena through design and performance.

The significance of this study is that it combines ethnomusicology, anthropology, and the emerging ecomusicology [2]. Ethnomusicology helps us understand the cultural background of musical instruments; anthropology explains their social functions and symbolic significance;

and ecomusicology (the study of the relationship between music, culture and nature) provides a framework for exploring how musical practice reflects and shapes the relationship between man and nature. Combining these disciplines can give us a new understanding of the connection between music and nature and transcend traditional subject boundaries [3].

The paper is divided into four parts: First, it studies the natural origin of music, African sound imitation and cross-cultural comparison through literature review. Secondly, we analyze the cases of three musical instruments in detail to explore their structure, sound characteristics and cultural role. Third, discuss how these instruments have changed people's understanding of music, their sociocultural functions, cross-cultural patterns, and their potential to redefine music. Finally, the conclusion section summarizes research findings and illustrates how Africa's nature-inspired instruments reveal the profound connection between human musical expression and the natural world.

2. Literature Review

2.1. Music and its Natural Origins

The relationship between music and nature has been studied since Darwin, and he thinks that music may have evolved from courtship calls. In *The Descent of Man*, Darwin [4] said that humans may have been able to hum before speaking during evolution, just like birds singing for courtship. McDermott and Hauser [5] concluded that Darwin's theory holds that music is "a biological adaptation whose functions include courtship and its unifying role in group activities such as religion and war"(p. 30). This evolutionary view suggests that music is not just a cultural invention, but an extension of natural vocal behavior in the animal kingdom. Archaeological evidence also proves the deep relationship between music and natural materials. Montagu [6] mentioned that "the earliest musical instruments we have identified came from Geissenklösterle and Hohle Fels in Swabia, Germany. They were made of swan bones, vulture wing bones and ivory, and belonged to the earliest Aurignacian period"(page 3), which suggests that early humans would turn natural materials into sound tools. These bone flutes are about 40,000 years old and are the earliest identified musical instruments, but Montagu [6] asked: "Natural materials such as grass, reeds and wood must have been used earlier than bones? "(page 3). This suggests that humans may have used natural materials to make sounds earlier, but no archaeological traces were left.

The classification system invented by Sachs and Hornbostel [7] helps us understand how musical instruments in different cultures use nature's sound principles. They divided musical instruments into four categories: idiophones (the instrument vibrates to produce sounds by itself), membranophones (the vibration of taut membranes), chorophones (the vibration of taut strings) and aerophones (the vibration of air). Von Hornbostel [8] said: "All indigenous musical instruments in Africa are made using replicable technologies that are both scientific and human"(p. 302). This system allows us to see that musical instrument makers in different places have actually discovered and utilized the same acoustic principles in nature.

There is now a new subject called ecomusicology, which focuses on the relationship between music and nature. Allen and Dawe [9] say it is "the study of the complex relationships between music, culture and nature"(p. 2). This method allows you to see how music activities reflect the relationship between ecological knowledge and the environment. Titon [10] believes that sustainability should be the focus of ecological musicology because music traditions rely on natural resources and the environment. Using this method to study African musical instruments that imitate nature, we can understand their relationship to the entire ecosystem and knowledge system.

2.2. African Music and Natural Sound Imitation

Research on African percussion often mentions its relationship with natural phenomena, such as rain, thunder, and animal calls. Agawu [11] criticized how Western scholars constructed the concept of "African rhythm". He said that although rhythm is overemphasized, the imitation characteristics of African percussion are actually more worthy of attention. He wrote: "Kwabena Nketia, the most well-known African scholar in the study of African music, uses the dominance of percussion to explain why African music appears simple in other dimensions"(p. 380). This emphasis on percussion creates sound effects that often resemble natural sound patterns.

Nzewi [12] discussed how the African membrane drum can be used as a "melody" instrument that can produce a melody that can be converted into singing voice. He pointed out: "The inner shell surface of the African membrane drum is rough, and this roughness is intentional to allow the instrument to emit rough overtones rather than pure pitches"(p. 15). This deliberate rough imitation of the complex timbre of natural sounds rather than the pure tones preferred by Western musical traditions. Similarly, Udofia [1] describes how different African musical instruments are classified according to their sound methods- "beaten","shaken","plucked" and "blown"-each corresponding to a different natural sound process.

The role of music in African rituals, celebrations and community life further demonstrates its connection with natural cycles and natural phenomena. Boer et al. [13] summarized ten cross-cultural functions of music, including emotional expression, social connection, and cultural identity. Their research shows that "music can reflect identification with a culture, comment on its history and current conditions for its members" (p. 8). In African culture, musical instruments that imitate nature are often associated with specific rituals such as agricultural cycles, rain-praying rituals, and seasonal changes. Aidoo [14] emphasized that "traditional musical instruments probably connect with their natural environment" (p. 20), which shows that this connection is both material and symbolic.

2.3. Cross-cultural Comparisons

Imitating the sounds of nature is not the only feature of African music. It is played all over the world. In China music, the erhu (a two-stringed instrument) is particularly good at imitating bird calls and animal calls. Li [15] said: "Huqin (musical instrument families including erhu) in different places have their own personalities and must complement local music. For example, people in Inner Mongolia use Matouqin to express their generous and cheerful character "(page 16). Although it does not directly say imitating sounds, this sentence shows that the same type of musical instrument will become different in different places, reflecting the local environment and cultural characteristics.

Sterckx [16] talked about the relationship between animals and music in ancient China. He said: "The call of a phoenix is like the sound of xiao... The soft cries are like bells, and the loud cries are like drums "(page 9). This ancient China view shows that the sound of nature is a reference for musical timbre in different cultures. In addition,"the bronze inscriptions and the words used to describe bells and bird calls in documents such as *The Book of Songs* are exactly the same"(page 19), which shows that the ancients believed that natural sounds and musical sounds were the same thing.

Western music also expresses nature, but in a more abstract way. Beethoven's *Pastoral Symphony* (Sixth Symphony) directly imitates bird chirping and thunderous rain, while modern composers such as John Luther Adams 'environmental music directly incorporates natural sounds into their works. Malloch and Trevarthen [17] believe that all music reflects that "we are born to know how to move with others, remember things together, and plan the

future together"(page 2), which shows that the natural rhythms of heartbeat, breathing, and walking are actually the basis of music in all cultures.

Cross-cultural research has found that although imitation is common all over the world, African cultures are particularly good at making instruments that reproduce natural sounds. Comparing them with instruments elsewhere can help us better understand the various musical expressions that have developed from natural sounds.

3. Case Studies of Instruments

3.1. Water Drum

Water drums are the best example of turning the sounds of nature directly into musical instruments. Its basic structure is a bowl-shaped container containing some water and a drum skin (previously made of animal skin) stretched on it. The biggest difference between it and ordinary drums is that water is specially used as a resonance material, so the sound it makes is particularly similar to the movement of the water itself.

Von Hornbostel [8] said: "Water drums... Very common in North America... Outside of America, only the Hottentots use this drum "(p. 283), indicating that it has been widely circulated and may have existed for a long time. In many African traditions, containers are made of hollowed out gourds or wood, and the drum skins are fixed with ropes, and the tightness can be adjusted. Water level affects pitch and timbre [12].

The sound it makes is low and echoing, with complex overtones, which sounds like water shaking. Scientists have found that it has these characteristics: the main frequency is between 80 and 150 Hz, the rich overtones make the timbre sound "wet", and the water will also produce a glide effect when playing [18]. As Nzewi [12] said: "The mixed overtones from this drum will always massage and soothe the nerves of the listener"(p. 15).

This unique sound effect is produced by special physical principles. When the eardrum is knocked, the vibration travels through both air and water, forming complex interactions. Water acts as both a shock absorber and a second resonance box, changing the vibration of the eardrum, producing the trademark "purring" sound. Scientists used instrumental analysis and found that the strongest part of this sound is between 200 and 800 Hz, which is exactly the range where human ears are most sensitive to sound texture [18].

In many parts of Africa, water drums are particularly important in activities related to water gods, harvests and purification rituals. Udofia [1] said: "In some tribes in Africa, such as the Annang people in Nigeria, certain musical instruments can only be played by specific families at specific times"(p. 191), which shows that there are strict rules for the use of sacred musical instruments. Among the Yoruba people, water drums are related to the freshwater goddess Osun, and they can be seen every year during festivals [19].

3.2. Ocean Drum

The ocean drum simulates the sound of waves by controlling the movement of small objects inside the sealed eardrum, eliminating the need for real water at all.

Its structure is a shallow cylindrical drum frame, usually 10-20 inches in diameter, with eardrums stretched on both sides. There are some small beads, seeds or pebbles between the eardrums. When you tilt or turn the drum, these things roll inside the drum, making a sound very similar to a real wave crashing against the shore. Von Hornbostel [8] classified these instruments as "rocking instruments" and mentioned that they are common in West and Central Africa.

The materials used in different places are also different. In coastal areas, people may use small shells to create more realistic wave sounds, while also symbolically incorporating ocean elements. The tightness of the eardrum is critical to sound quality. It determines the

resonance effect of the drum cavity and also affects the sound when the internal material hits the eardrum [14].

The sound characteristics of ocean drums are particularly like waves and wind. Acoustic analysis found that its sound included broadband noise caused by multiple particles moving simultaneously, rhythmic patterns formed by the collective movement of internal materials, and resonant frequencies determined by the drum's size. If playing with good skills, ocean drums can produce sounds in the frequency range of approximately 100 Hz to 8 kHz, ranging from the low roar of distant waves to the high-frequency splash of spray [18].

The physical principles here are complex, involving the interaction between the materials in the drum and the resonance cavity. When the drum body is tilted, gravity causes the small particles inside to move, simulating the random but regular movement of water molecules. By changing the speed and angle of the shaking, players can imitate different ocean conditions, from gently flapping waves to violent storms.

In African tradition, ocean drum is often used in rituals related to fishing, navigation safety, and water gods. Agawu [11] mentions that instruments such as the ocean drum demonstrate their clever use of timbre and texture to "make up for missing or insufficiently complex melodies"(p. 380). It can create a constantly changing, non-repetitive sound texture, so it can help people enter a trance state during certain rituals.

In addition to traditional uses, ocean drum also has modern applications, such as music therapy. Its soothing, unpredictable sound can help relax and relieve stress [13].

3.3. Rainstick

Rainstick mimics the sound of rain with a simple yet clever design. Although people often think it comes from South America, it is actually important in Africa's musical tradition, especially in places where rain has special cultural significance.

In Africa, rainstick is usually made of hollow plant materials-such as bamboo, reed or sun-dried gourd containing small stones, seeds or beans, as well as internal obstacles. When you turn it upside down, the contents will slowly fall, making a rustling sound like rain. These obstacles-usually small thorns or sticks inserted into the wall of the pipe, arranged in a spiral-cause the contents to fall slowly and fall apart, creating a unique raindrop sound. The length of the tube, the type and quantity of things contained inside, and the arrangement of obstacles can affect the sound effect [14].

Its sound is very similar to real rain. Sound analysis shows that its noise energy is concentrated at 1-8 kHz (similar to the frequency of real rain), which is first dense in time and then gradually sparse, and has a subtle resonance frequency, depending on the size of the tube. However, real rain is relatively uniform, and rainstick's sound changes from dense to sparse-a feature that makes it particularly suitable for marking paragraph transitions in musical performances [18].

There are not only the physical phenomena of many small things moving around, but also the principle of sound filtering. When the material inside falls, they will hit obstacles and each other, making thousands of small collisions. The hollow tube acts like a resonance box, amplifying certain sound frequencies while attenuating others. The final effect not only captures the key feature of rain-the timing when many similar events occur randomly-but also makes the sound musical through resonance.

In African culture, rainsticks often appear in rain-praying rituals and agricultural activities. Montagu [6] said: "Music has four main uses: dance, ritual, personal and collective entertainment, and the most important is social cohesion"(page 5), and raintick can achieve all these functions. It is used in rain-praying rituals as a form of sympathetic witchcraft, and

people believe that the sound of musical instruments can induce similar rainfall phenomena in nature.

Raintick's symbolic meaning is not just a literal "prayer for rain," but also includes broader meanings, such as harvest, rebirth and water circulation. In many agricultural communities, it is used to mark seasonal changes and is also used in sowing and harvesting rituals, with multiple meanings related to survival, growth, and the relationship between man and nature's cycle.

These three cases demonstrate the different methods of imitating natural sounds in the African musical instrument tradition. Each captures the key characteristics of natural sounds while undertaking specific cultural functions, indicating that African instrument makers have developed complex technologies that can transform feelings about the environment into musical expressions.

4. Discussion & Analysis

4.1. Nature and the Concept of Music

Instruments such as the water drum, ocean drum and raintick challenge the traditional Western definition of music-the belief that music is just an art created by humans. They prove that music can be understood as an extension of natural sounds, cleverly transformed by humans, but still retaining its essential connection to the natural environment. As Malloch and Trevarthen [17] said, music stems from "our innate ability to resonate with others through time, to act, remember, and plan"(page 2)-an ability that evolved to adapt to the rhythms and patterns of nature.

The instruments in this study showed varying degrees from direct imitation of natural sounds to creative transformation. A water drum uses water directly to reproduce its sound characteristics; an ocean drum mechanically simulates the sound of water; and a raintick abstracts the random characteristics of rainfall into a controllable sound emitting device. Each instrument does not symbolically imitate nature, but through design and playing techniques, it actually reproduces the sound phenomena of nature.

This development process shows the evolution of humans from simply imitating nature to interacting with nature. The earliest musical expressions may have begun by directly imitating environmental sounds-such as bird chirping, animal roars, wind, water-before developing more complex forms of interaction. McDermott and Hauser [5] pointed out: "The earliest thing found to be a musical instrument is a bone 'flute' about 50,000 years old"(p. 31), which suggests that even prehistoric humans were transforming natural materials into tools that can make sounds, rather than simply imitating them.

The African instruments we studied demonstrate a profound understanding of the principles of sound in natural phenomena. They are not just imitating, they are more like talking to nature-human creativity is based on the natural vocal process and further expands it. This view is consistent with Montagu [6]: "Music must first be defined and distinguished from language, animal and bird calls... The movement impulse of apes suggests that rhythm may appear earlier than melody"(p. 2). When we realize that musical structure is deeply rooted in natural patterns, the line between natural sounds and human music becomes blurred.

4.2. Social and Cultural Functions

In addition to sound characteristics, these instruments that imitate nature also have important social and cultural roles. They hide ecological knowledge in music to help us remember to protect the environment. For example, water drum is used in rituals to sacrifice to water gods, indicating that people know how important water is to life;ocean drum is used in coastal communities to connect ocean knowledge with music; raintick is used in

agricultural rituals to indicate that farmers understand the regularity of rainfall is important to farming.

Boer et al. [13] stated that an important function of music is to help people remember "who we are." They found that "music can express the characteristics of a culture and tell its history and current situation"(p. 8). These natural instruments allow people in different places to remember their relationship with the environment through music. Villages that use water drum to worship the river god are telling the story of themselves and the river; coastal residents use ocean drum in nautical ceremonies to tell everyone that "we rely on the sea to eat"; farmers use raintick to pray for rain to emphasize the close connection between crops and the rainy season. These instruments also strengthen the bond between people by playing music together. Udofia [1] points out that in Africa,"players use the musical language to convey information from the instrument to the audience by manipulating the instrument"(p. 196). When this message contains natural sounds familiar to all community members, it creates a common reference point and strengthens a sense of collective identity. Many African musical traditions feature participation, which further enhances this social function, as community members promote group cohesion when using instruments that mimic nature.

The connection between these instruments and ritual activities is particularly important. In many African societies, musical instruments that mimic nature serve as bridges between human communities and natural or spiritual forces. The connection between water drums and water gods, the role of ocean drums in fishing rituals, and the use of rain sticks in rain-praying rituals all demonstrate how these instruments promote communication between human and non-human realms. As Nzewi [12] said: "In African communities, some instruments are responsible for melody and some are responsible for rhythm"(p. 17), each instrument has a specific function in the ritual.

4.3. Cross-cultural Implications

Compare African musical instruments that imitate nature with other cultures and you will find that they have both common ground and their own characteristics. For example, erhu in China and water drums in Africa: they both imitate natural sounds, but erhu uses bows and tone changes to learn the chirping of birds and animals, while water drums directly put water into drums to change the sound. Li [15] said that the differences in playing stringed instruments across China "reflect the power of national psychology, social culture and the spirit of the times"(page 14), which shows that the way of imitating nature is related to cultural values.

Behind these practices are different philosophical ideas. African musical instruments often use natural materials directly in their designs, while China traditions (influenced by Confucianism and Daoism) prefer symbolism and technical skills. Sterckx [16] mentions the ancient belief in China that "the sound made by musical instruments comes from the animals decorated on them"(p. 19)-this is a symbolic connection, not physical.

These traditions are still used today: eco-music composers use techniques such as water or ocean drum to imitate natural sounds; film soundtracks use rainsticks to imitate the sound of rain (without recording) to create an atmosphere; voice therapy also uses these instruments to relax because the human nervous system responds to them as it does to real natural sounds.

4.4. Redefining Music

The instruments we studied that mimic nature made us rethink what music is. They tell us that music should not be just an "art of sound"-something created by humans that is different from natural sounds-but more like a "bridge between man and nature." This idea is very similar to what Malloch and Trevarthen [17] called "communicative musicality", which is "we

are born with the ability to move with others, remember things, and plan things"(page 2)-this ability actually evolved with the rhythm of nature.

African instruments can particularly break the Western idea that music is too narrow, such as only caring about score music, complex harmonies or how composers write music. Agawu [11] criticized that Western scholars always say "African rhythm" in a particularly mysterious manner, but in fact, many African languages do not even have the word "rhythm", even though they are extremely good at playing rhythm. Similarly, the instruments that imitate nature in this study also show things that Western music classifications often ignore, such as timbre, texture and how to interact with the environment. These gameplay methods are actually particularly advanced.

Water drums, ocean drums, and rain sticks give us a more inclusive definition of music, it recognizes the continuity between natural sound and human musical expression. This view fits well with the research approach of ecomusicology, which focuses on how musical practice reflects and affects the relationship between humans and nature (Challe [20]). Allen and Dawe [9] define ecomusicology as "the study of the complex relationship between music, culture and nature"(p.2), a framework that explains the blurred boundaries between the natural sounds represented by these instruments and music.

The impact of this redefinition goes beyond academic discussion. Seeing music as a bridge between man and nature can encourage us to make music in more sustainable ways, such as considering the source of instrumental materials and the impact of musical activities on ecosystems. It also affirms indigenous and traditional music knowledge-who have long recognized these connections, which may lead to more mutual respect for music exchanges between different cultures.

The African instruments we studied show that music is not only an invention imposed on nature by humans, but also a creative extension of the principles of nature's acoustics. They demonstrate that while humans develop complex instrumental technology and cultural practices, musical expression can still remain connected to environmental roots. Recognizing these connections, we will have a more complete understanding of the origin, function and potential of music-music is not just a human art form, but also a dynamic interaction between human creativity and the sound environment that breeds it.

5. Conclusion

The study explores how traditional African musical instruments-particularly water drum, ocean drum and raintick-mimic natural sounds, and how this reveals the relationship between music and nature. Through a detailed analysis of the structure, acoustic properties and cultural functions of these instruments, we discover a profound connection between musical expression and natural phenomena, which challenges traditional Western definitions of music and provides us with a new perspective on how humans transform environmental experiences into artistic creation.

By using real water as the resonance medium, water drum may be the most direct example of transforming natural acoustic principles into musical instrument form. Its unique "moist" timbre and complex overtones truly reproduce the rippling sound of the water waves, while playing an important role in ceremonial and social functions involving water gods and purification rituals. The ocean drum simulates wave patterns by using small beads or pebbles inside as they shake, capturing the statistical characteristics of ocean sounds without using the water itself, demonstrating how mechanical principles can effectively mimic natural acoustic phenomena. Rainstick uses its clever built-in channel system to transform the simple action of falling particles into realistic rainfall simulations, demonstrating that as long as the

basic characteristics of natural sounds are understood, they can be reproduced through relatively simple techniques.

These instruments tell us that music is actually in the same line as natural sounds, rather than something completely different. They show different ways to imitate sounds-some add natural elements directly, some use mechanical devices to simulate them, and others use abstract methods-but all allow people to recognize their connection to nature. This shows that music is more like an extension and transformation of natural sound, rather than an invention that humans impose on nature.

The use of these instruments in African society and culture further illustrates their importance. They are used in rituals related to farming cycles, water god sacrifices, and seasonal changes, showing that musical activities actually contain ecological knowledge and environmental awareness. Many African musical traditions encourage participation, and when entire communities play these instruments that imitate nature together, they not only strengthen people's unity but also deepen their relationship with nature.

Cross-cultural comparisons (such as erhu in China) find that there are similarities in the way people imitate natural sounds, but different cultures have their own characteristics. Although techniques and ideas vary, the impulse to incorporate natural sounds into music is cross-cultural-suggesting that humans are inherently interested in connecting art and the environment.

The research uses an interdisciplinary framework (ethnomusicology, anthropology, ecomusicology) to advance scholarship. Ethnomusicology studies the cultural background and significance of musical instruments; anthropology connects them with cultural values and cosmology; and ecomusicology studies their role in the interaction between man and nature.

Combining these perspectives, the study found that African instruments that mimic nature challenge the definition of music. They do not see music as "a sound created by humans and separated from nature", but as a "bridge between man and nature"-using high-tech means to extend the sound in the environment.

These instruments have inspired both modern music and environmental awareness. In the context of global ecological issues, they remind us that human creativity has long been closely connected to nature, and that music should strengthen (not cut) this connection. The ancient technology of imitating sound provides wisdom on the relationship between sound and the environment now and in the future.

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