

Bringing ancient stories to life: Dinosaurs are cool, but no hominids please!

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Introduction

The rich palaeontological heritage of South Africa puts the country in a world-leading position in this research field and presents unparalleled opportunities for public science communication and engagement. This panel discussion presented three case studies to compare the challenges in communicating about dinosaurs (where very little public resistance is experienced) versus human ancestors and evolution in general (where announcements sometimes spark controversy and debate). The presentations highlighted the inspirational and educational potential of communicating about dinosaurs, contrasted against the socio-political risk and sensitivities associated with public communication about human ancestors. Research into visitor experiences at the Cradle of Humankind confirmed that one could not expect people to engage deeply with educational content about evolution during a single visit to a visitor centre at a palaeontological site.

Dinosaurs? No problem!

Prof Anusuya Chinsamy-Turan, a leading expert on the microscopic structure of dinosaur bones at the University of Cape Town, presented a personal account of popularising her research.

As a dinosaur palaeontologist, I find that getting people excited about my topic is relatively easy: dinosaurs are enthralling! The fascination with dinosaurs possibly stems from the fact that, unlike mythical creatures such as dragons, unicorns or centaurs, dinosaurs actually lived, and dominated our planet for 160 million years. Today, most of what remains of these amazing animals are their hard parts – their bones and teeth. Occasionally, we find impressions of tracks and trackways or casts of their soft tissues.

Many children's first interaction with science is through dinosaurs. Mostly through play, they learn how to classify organisms, they engage with morphology, form and function, and figure out ecological relationships such as predators, prey, parental care, herding, etc. Thus, their curiosity about nature, and science in general, is sparked. In my experience, public engagement about dinosaur research can nurture this natural interest in the world around us, and science in general.

However, in South Africa public engagement with science faces a myriad challenges. The legacy of apartheid has led to an under-representation of black South Africans and women in science, resulting in a critical need to attract more of these societal groups into science careers. Compounding this is the problem of uneven access to higher education and high-quality learning infrastructure in the country. These limitations impede access to and participation in science. Negative perceptions and stereotypes around science, as well as beliefs about who can or cannot "do" science, are other major obstacles. Curiously, some negative anti-science sentiments are being spurred on by a few high-ranking politicians.

Despite these challenges, it is imperative to correct the imbalance in South Africa's science workforce by attracting more black people and women to careers in science. This can only be achieved if scientists share the responsibility to inspire and motivate the youth.

Growing up in South Africa, I knew very little about dinosaurs. My personal fascination with dinosaurs was only sparked at university. I soon realised that South African public audiences didn't know much about our local heritage of dinosaurs, or even about dinosaurs that roamed the African continent. This inspired me to do public lectures, visit schools, write popular articles and help raise money for an African dinosaur exhibition at the Iziko Museum in Cape Town.

My first popular science book, "*Famous Dinosaurs of Africa*", was an effort to reach wider audiences. This book, beautifully illustrated by palaeo-artist Luis Rey, generated significant interest and is, to date, the only children's book that focuses entirely on African dinosaurs. Spurred on by the response to this book, I wrote a second popular science book. "*Fossils for Africa*" tackles concepts which I found people often grapple with, such as how life on Earth changed over 3.8 billion years.

I feel that it is important that aspiring scientists should know that there is still new research being done, and that there are still many unanswered questions. That is why I try to write a press release every time I publish new research. I'm currently working on a MOOC (massive open online course) on the topic of extinctions through *Futurelearn.com*, hoping that I will reach many more people through this (free) online course.

But, what about the hominids?

Shirona Patel, communication manager at the University of the Witwatersrand, shared the science communication successes and lessons learned around the announcement of a major new fossil find in South Africa.

The discovery of a new species of human relative – *Homo naledi* – was announced in the scientific journal *eLife* in September 2015. The announcement came from Prof Lee Berger from the University of the Witwatersrand (Wits), along with several partners. A second paper, with lead author Prof Paul Dirks of James Cook University in Queensland, Australia, suggested that the species appeared to have intentionally deposited bodies of its dead in a remote cave chamber, a kind of behaviour previously thought to be limited to humans.

An international team of scientists conducted the research. Consisting of more than 1 550 numbered fossil elements, the discovery was the single largest fossil hominid find yet made in Africa. The initial discovery was made in 2013 in the so-called Rising Star Cave in the Cradle of Humankind World Heritage Site, some 50 kilometres northwest of Johannesburg, South Africa, by Wits University scientists and volunteer cavers.

The fossils, which have yet to be dated, lay in a chamber about 90 meters (some 100 yards) from the cave entrance, accessible only through a chute so narrow that a special team of very slender individuals was needed to retrieve them. So far, the team has recovered parts of at least 15 individuals of the same species, a small fraction of the fossils believed to remain in the chamber.

Homo naledi was named after the Rising Star cave. "Naledi" means "star" in Sesotho, a local South African language. *H. naledi* had a tiny brain (about 500 cubic centimetres) perched atop a very slender body. On average *H. naledi* stood approximately 1.5 meters tall and weighed about 45 kilograms. *H. naledi*'s teeth are described as similar to those of the earliest-known members of our genus, such as *Homo habilis*, as are most features of the skull. The shoulders, however, are more similar to those of apes. The hands suggest tool-using capabilities. *H. naledi* has extremely curved fingers, more curved than almost any other species of early hominid, which clearly demonstrates climbing capabilities. This contrasts with the feet of *H. naledi*, which are

indistinguishable from those of modern humans. Its feet, combined with its long legs, suggest that the species was well-suited for long-distance walking.

The context of the find has led the researchers to conclude that this primitive-looking hominid may have practiced a form of behaviour previously thought to be unique to humans. The fossils —which consist of infants, children, adults and elderly individuals —were found in a room deep underground that the team named the Dinaledi Chamber, or “Chamber of Stars”. That room has “always been isolated from other chambers and never been open directly to the surface”, according to Prof Dirks. “What’s important for people to understand is that the remains were found practically alone in this remote chamber in the absence of any other major animal fossils.”

The announcement made global headlines and was the biggest story world-wide for the global wire agency, Reuters on 10 September 2015. It featured on the front page of more than 40 major newspapers worldwide and trended globally at various times throughout the day.

The fossils were put on public display for several weeks at the Maropeng Visitors’ Centre, and visits to the site increased fivefold during this period. It resulted in global tours for the team, cast handovers and visits by high-profile international delegations. Public concerts and other tourism events were held to advertise the unique fossils of Africa to its own people and the world.

The campaign focused on shared research, new knowledge and open access elements, allowing multiple young scientists, cavers, and even so-called “underground astronauts” to participate in the process.

It was a great story with many unique angles, told by great storytellers, featuring professionally produced material, produced through professional media partners, distributed in collaboration with the government, the media, authors, public information officers and other partners. However, there was resistance from some quarters.

The team had anticipated criticism from those that do not accept evolution. These kinds of objections were anticipated from lay persons, but not from influential trade union leaders in the country. On the one hand, the notion that *H. naledi* was a human ancestor was rejected and the research was labelled by some as racist pseudoscience designed to dehumanise black people. On the other hand, people argued that if *H. naledi* was indeed a human ancestor, it was unacceptable to disturb such an ancestral burial site.

The science was also contested by fellow scientists, something that is not uncommon in the field of paleosciences. Many critics specifically questioned the evidence that *H. naledi* had buried their dead.

In response to these criticisms the research team engaged in dialogue and debate, responded to questions in the mass media and repeatedly invited critics and lay persons to view the fossils in order to make up their own minds.

The timing of the papers and choice of scientific platform also came under fire. Four papers relating to *H. naledi* were published in September 2015. The first two were in *eLife* (new species and context) and the second pair (hand and foot) in *Nature Communications*. The team was criticised for not following traditional ways of undertaking science; using new publication routes and accused of “rushing science in order to serve the needs of the media”. In response, the researchers on the team explained – where possible – that they purposefully adopted new ways of doing science by including more than 60 scientists to form working groups that collaborated in the analyses of these fossils. The four papers all had different lead authors. Using novel technologies – including 3D-scanning and new software – allowed analysis “within rock”, thereby eliminating the need to chip away at the rocks manually for several months and speeding up the process from research to publication. The focus on open access was also one that the team wanted to explore.

There was much speculation around the age of the fossils and criticism leveraged at the team for not dating the fossils before making the announcement. The research team explained that the standard dating techniques – use of uranium, cosmogenic nuclide dating and radiocarbon dating – were not suitable for these fossils and that further work needed to be undertaken before they could be dated.

..A key learning point was that communicating science is not without risk, but that criticism also provided opportunities for further engagement and dialogue about the need for evidence to support any scientific claims. The public debate further provided hooks to reflect on the nature of science (asking questions and engaging with different views) and the process of science (how long it takes; new techniques used).

Before announcing a major discovery of this nature, researchers need to anticipate what could “hit a nerve” and what could be misunderstood.

This project has highlighted once again how important it is for scientists to be prepared for public resistance when their findings may challenge people’s religious or cultural beliefs.

In terms of the scientific criticism, we were reminded of the importance to acknowledge any uncertainties upfront, and to highlight work that still needed to be done.

While widespread coverage in traditional and social media is the only way to achieve broad public awareness and interest in a scientific discovery, there is also a fine line between publicity and hype. This is a difficult balancing act, and should be managed carefully so as not to compromise the science. Moreover, it is extremely important – but also very difficult – to manage the agendas and expectations of the science, funding and media partners.

Despite the criticism – from a science communication perspective, judged by the extensive global media and public interest – the announcement was successful in raising the profile of the palaeosciences and the Cradle of Humankind.

Visitors’ views and experiences at the Cradle of Humankind

By Prof Anthony Lelliott, education researcher at the University of the Witwatersrand, presented research on visitor experiences and impressions at the Cradle of Humankind.

The “Cradle of Humankind” was declared a World Heritage Site in 1999 because of the nature and extent of the fossil hominids discovered there. Currently, the visitor centres receive up to 250 000 visitors per year, comprising local and international tourists and school excursions. Little is known about why visitors go there or what aspects of the visit they find memorable. Our study set out to determine visitors’ awareness of australopithecines; their acceptance of human evolution and their motivation for visiting the Cradle of Humankind. We also wanted to find out what aspects of the visitor centre made the biggest impression on visitors. (This research was carried out before the *Homo naledi* announcement.)

We questioned 811 members of the general public who visited the Maropeng visitor centre and Sterkfontein visitor centre within the Cradle of Humankind.

Our results show that 81% of visitors have heard of “Mrs Ples” (*Australopithecus africanus*) discovered in 1947, a fossil that has been relatively well publicised in South Africa, but only 10% have heard of “Karabo” (*Australopithecus sediba*), discovered in 2008.

We asked participants “Do you accept that humans evolved from an ape-like ancestor?” in order to ascertain their views on human evolution, while avoiding the notion of “belief”. We found that 59% accepted the concept and 25% did not, while 16% did not state their opinion or gave another answer.

In terms of the motivation for people to visit, 44% gave answers relating to “learning” and “interest”, “tourism” was relatively minor motivation. “Recommendation” and “culture” were low motivators.

In response to the question “Did anything you saw today make you think differently about human origins?” 53% of Maropeng visitors and 40% of Sterkfontein visitors replied positively. When explaining their thinking, participants referred to evolution, human origins, the concept of deep time, increase in knowledge, the environment and sustainability (64% of responses). They also mentioned science and religion, the unity of mankind, the common ancestor of humans, the origin of humans in Africa and religious issues (18% of responses).

More than 80% of visitors at both centres said that they could remember something that made a specific impression on them. At Maropeng, 25% of participants referred to the boat ride (a typical ‘theme park’ experience). Other memorable items were the exhibits, information, fossils and “everything” (36%). Also, the “vortex”, the “caves”, earth history and evolution (22%). At Sterkfontein, 42% of participants referred to the caves and the underground lake. Other memorable items were the hominid fossils, the tour guides’ knowledge, and evolution/human origins (26%). Also, rock formations, quality of the facility and fossils (19%).

Our findings that about 58% of visitors accepted human evolution are in line with other surveys at museums elsewhere in the world. Nearly half of visitors referred to “learning” and “interest” as motivating factors for their visit to the Cradle of Humankind. The most memorable experiences they took away with them involved the boat ride, the caves and the underground lake, which showed that people tend to remember the enjoyable and immersive aspects of the visit. In a single visit, one cannot expect people to engage deeply with issues of human origins.

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