SOUTH AFRICA

Science communication throughout turbulent times

Marina Joubert and Shadrack Mkansi

1. Introduction

Science is practised within the contexts of societies. What's more, the public communication of science is sculpted by politics, culture and socioeconomic realities. As such, the relationship between science and society in South Africa is historically defined by our turbulent political past, and continues to be moulded by present-day challenges. Over the past 25 years, pivotal policy transformations have opened up new possibilities and inspired ambitions for developing a critically engaged knowledge society. However, some formidable obstacles remain in the pursuit of this goal.

2. The long shadows of colonialism and apartheid

In early African societies science and technology were integral elements of culture. This is demonstrated by archaeological evidence of remarkable ancestral abilities in prospecting and tool-making (Boshoff et al., 2000). Moreover, ancient fishing technologies, developed over a period of 10,000 years, are still in use in rural Africa (Bruton, 2016).

The colonial period brought social disruption, but also scientific exploration. During Dutch and British rule in South Africa (intermittently 1652–1910), the colonialists exploited local resources for the benefit of their imperial masters (Dubow, 2006; Huigen, 2009). Driven by intellectual curiosity, amateur scientists charted the interior of the country, while collecting

mammals, birds, fishes, insects, fossils and plant specimens for collections housed in Europe. Colonial science served the interests of the local elite in navigation, astronomy and cartography. In later years, mining, plantations and medicinal plants also became important. Colonial intellectuals defined and described the indigenous people of Africa (Dubow, 2006) and many prominent naturalists visited the Cape. William Burchell, for instance, visited in 1822 and 1824 and popularised his explorations in two volumes, *Travels in the Interior of Southern Africa*. In 1836, the 27-year-old Charles Darwin spent almost three weeks in South Africa on the last leg of the five-year voyage of HMS *Beagle* (Thackeray, 2009). Between 1828 and 1833, Scottish surgeon and explorer Sir Andrew Smith led several expeditions into little-known parts of the country, resulting in a five-volume illustration of the zoology of South Africa. From the mid-1850s onwards, local scientists reported their discoveries to the science community in London via the *Cape Monthly Magazine*¹ (Dubow, 2006), but many field notes either remained unpublished or were destroyed when power changed hands at the Cape (Boshoff et al., 2000).

The notion of science as a tool to conquer and tame Africa and harness its resources lasted well into the 20th century (Tilley, 2011). Racial segregation and white privilege were well established and intellectual discussions focused mainly on matters of Western science and society, while legislation enforcing inferior education and work opportunities for black people suppressed the development of the majority of the population (Dubow, 2006; Du Plessis, 2015).

Political interference in science peaked during the Apartheid Era (1948–93), a period characterised by state control, censorship, strategic investments in science and secretive research (Dubow, 2006; Du Plessis, 2017). Science was viewed as a political tool, with scant regard for public accountability. The South African Broadcasting Corporation (SABC) supported apartheid (Tomaselli, 2002) and stringent laws clamped down on press freedom, with scientifically classified information tightly controlled by the state. For example, during the height of apartheid, official permission was needed to mention ‘atomic energy’ in the media and defiant journalists faced heavy fines and/or long-term imprisonments (Du Plessis, 2017). Consequently, the public, including most scientists, knew very little about the extent of South Africa’s nuclear weapons capabilities.

1 One of the earliest examples of South African scientists being urged to disseminate their work more broadly dates back to an 1860 edition of the *Cape Monthly Magazine*. Editor Roderick Noble accused scientists of ‘having a hardness about them’ and presenting their work as a mere ‘dry narration of facts’ (Noble, 1860).

In 1953, the Bantu² Education Act³ limited the education of black children to basic reading and writing. It was during this time that the apartheid architect Hendrik Verwoerd infamously said: 'There is no place for [the Bantu] in the European community above the level of certain forms of labour ... What is the use of teaching the Bantu child mathematics when it cannot use it in practice?'⁴

The close relationship between the National Party and the Dutch Reformed Church meant that religion shaped the values, norms and institutions of the ruling party (Ritner, 1967). With evolution banned from school curricula, curators at natural history museums were not allowed to refer to evolution in their displays, unless they indicated explicitly that evolution was presented as a theory rather than fact. In the 1970s, Transvaal Museum director Bob Brain bypassed this restriction by calling his two major exhibitions halls 'Genesis I' (for the evolution of life from microbes to mammal-like reptiles) and 'Genesis II' (for the exhibition hall dealing with mammals, including humans and their distant relatives). In both halls, the concept of evolution was reflected using evolutionary trees (phylogeny), without referring to evolution by name.⁵

Due to its apartheid laws, South Africa was politically isolated and faced stringent economic sanctions and cultural boycotts. Despite this, the South African science base strengthened and the country developed advanced facilities and expertise in fields such as geology, mining, energy, nuclear science, space science, medicine, agriculture, veterinary science and the natural environment (Sooryamoorthy, 2010).

Many academics defied apartheid and were actively involved in the struggle. They found a measure of protection from political meddling within the more liberal universities in the country, but even prominent South African scientists were occasionally 'tarred by an apartheid brush' and denied access to international societies and conferences (Wood, 2012, p. 40).

2 A collective term (incorrectly) used by the National Party to describe black people of African origin; the term later became a symbol of oppression. See South African History Online www.sahistory.org.za/article/defining-term-bantu.

3 Act No. 47 of 1953, Parliament of South Africa.

4 Dr Hendrik Verwoerd, South African Minister for Native Affairs (Prime Minister from 1958 to 1966), speaking about his government's education policies in the 1950s. See Apartheid Quotes About Bantu Education: www.thoughtco.com/apartheid-quotes-bantu-education-43436.

5 Personal communication with Francis Thackeray, October 2018.

In terms of science, the legacy of apartheid is ambivalent. Extensive investment in military and energy research resulted in cutting-edge innovations and sophisticated science-based industries, but it also created an inward-looking science with no regard for social justice and failed to provide basic services such as shelter and clean water to most South Africans (Mouton, 2006). Many (not all) scientific institutions in the country were an integral part of a system that promoted the (white) Afrikaner identity (Dubow, 2006). Public communication of science was mostly restricted to corporate communication efforts produced by scientific institutions (Du Plessis, 2017). Consequently, black South Africans remained entirely disconnected from science.

3. Pioneers of science communication in South Africa

Some of the earliest scientific institutions in South Africa were established by the British, including the South African Library (1822), the Royal Observatory at the Cape (1828) and the South African Museum⁶ (1825). The Southern African Association for the Advancement of Science (also known as the S₂A₃) dates back to 1902 (Boshoff et al., 2000), while the Royal Society of South Africa, established in 1908, contributed significantly to intellectual vibrancy during the 20th century (Carruthers, 2008). Several scientific organisations currently leading science in South Africa were established shortly before or during the apartheid years, including the Council for Scientific and Industrial Research (established in 1945), as well as the Medical Research Council and the Human Sciences Research Council (both founded in 1969).

Despite the impediments presented by 20th-century politics, there were many gifted South African scientists⁷ who were passionate about sharing their work with society. Some trailblazers and memorable milestones are listed below, with more details in footnotes.⁸

6 In its early years, the South African Museum was regarded as 'a private club for knowledgeable gentlemen' and it was not easy for the public to get access (Dubow, 2006, p. 37).

7 Early South African science popularisers include the writer and naturalist Eugene Marais (1871–1936); the first warden of the Kruger National Park James Stevenson-Hamilton (1867–1957); entomologist and author Sydney Harold Skaife (1889–1976) and fisheries scientist and oceanographer Cecil von Bonde (1895–1983), as well as the notable conservationists Thomas Chalmers Robertson (1907–89) and Ian Player (1927–2014). In the 1910s and 1920s, Sir George Cory became known for presenting spectacular chemistry shows to his students and the general public (Bruton, 2018).

8 This list is necessarily incomplete; if space allowed, many more names and events could be included.

Figure 32.1: The first human heart transplant on 3 December 1967 made a science celebrity of South African surgeon Christiaan Barnard and changed relationships between medicine, media and society globally.

Source: Heart of Cape Town Museum (used with permission).

The epic discovery of a living coelacanth off South Africa's coast, a fish thought to have been extinct for 65 million years, ignited global and local interest (Bruton, 2015, 2018). On 22 December 1938, museum official Marjorie Courtenay-Latimer found the unusual fish while inspecting a local catch. It was later identified by ichthyologist J. L. B. Smith. In December 1952, when Smith returned to South Africa with a (second) coelacanth caught in the Comoros, the SABC interrupted their regular programming to air a radio interview with him, recorded on the tarmac at Durban Airport. This interview was subsequently broadcast worldwide by the BBC and North American radio stations. Smith became a regular voice on radio and later television, sought after by journalists for his expertise on aquatic life and views on conservation. He wrote more than 800 popular science articles during 1940–60 period, and his scientific bestseller *Old Fourlegs: The story of the Coelacanth* sold over 800,000 copies and was translated into nine languages (Bruton, 2017).

In Cape Town on 3 December 1967, Christiaan Barnard (1922–2001) performed the first human heart transplant.

The dramatic nature of this medical milestone, along with the media flair of the charismatic surgeon himself, captured global attention and fundamentally changed the relationship between medicine, media and society around the world (Joubert, 2018a). At the time, the South African government saw an

opportunity to improve South Africa's image and tried to co-opt Barnard as an ambassador for his country (Logan, 2003). When Barnard publicly spoke out against whites-only wards in hospitals, he was rebuked by then state president Nic Diederichs who warned that government would no longer protect him against his critics (Molloy, 1992).

The eminent paleoanthropologist Phillip Tobias (1925–2012) was another of South Africa's science icons. Based on his conviction that 'race is irrelevant in matters of the mind and spirit' (White, 2012, p. 423), Tobias fought against racism, specifically in universities and the scientific community. He became the first leading scientist in South Africa to present and narrate a television series. The six-part series *Tobias's Bodies* aired on SABC television in 2002 and took viewers on a fascinating journey of human evolution and its relevance to life in the 21st century. Notably, Tobias also used this science television series as a platform to combat racism.

4. Developments since democracy

Since 1994, democracy has fundamentally transformed South African society, including its science–society interface. The new government viewed public science engagement as a tool to help correct past imbalances and enhance socioeconomic growth. For the first time in the history of the country, the broad dissemination of science formed part of national science policy.

The White Paper on Science and Technology (DACST, 1996) underlined the transformational power of public engagement with science, and emphasised the importance of a society that valued science. It encouraged research organisations to participate in awareness-raising campaigns, and urged researchers to articulate clearly the benefits of their work to decision-makers and the public. Amidst this new enthusiasm for science communication, there were also significant challenges. Because of past political barriers most South Africans were disconnected from science; with few exceptions, the demand for increased public engagement was also new (and unwelcome) to many scientific institutions and scientists.

As one of its first major public engagement initiatives, the new government declared 1998 'The Year of Science and Technology' (YEAST'98). It was a signal that 'something has to be done to give South Africans a wake-up call', said then Minister of Arts, Culture, Science and Technology Lionel Mtshali (DACST, 1998). During this year-long nation-wide science communication campaign, exhibitions, science shows and public talks were organised in each of the nine provinces of South Africa. The aims were to demystify science as well

as to create a special period during which much of the attention of the nation and the media would focus on science and technology. The campaign was also geared towards helping to realise Thabo Mbeki's (deputy president at the time) vision of an African Renaissance (DACST, 1998; Boshoff et al., 2000). Mbeki referred to YEAST'98 as 'a new movement which will ensure that our country is prepared for the challenges of the new millennium' (DACST, 1998). Based on the proclaimed success of this campaign, the government implemented an annual science week with the objective of 'taking science, engineering and technology to our people' (DACST, 1999, 2000). But the aims of YEAST'98 were not only overly ambitious, they were also too vague to be measured effectively. Therefore, a meaningful evaluation of YEAST'98 was not possible. The only indicator of success for these events was the number of people who participated, without regard for whether their participation made any difference to how they viewed or used science in their daily lives. Ironically, in many cases, this superficial approach to evaluating science engagement initiatives persists to this day (Weingart and Joubert, 2019).

In the early years of government-funded science engagement initiatives in South Africa, the objective of 'demystifying' science was a prominent goal, illustrating that science was perceived to be unknown, almost foreign, to most South Africans. Since then, terms such as 'awareness', 'outreach' and 'dissemination' have been used frequently. The prominence of 'engagement' in more recent policies and reports reflect the desire for more interaction and dialogue between science and society.

At grassroots level, those involved in the government-sponsored science awareness events in the early years of democratic South Africa experienced many challenges and obstacles. Despite efforts to spread activities around all nine of South Africa's provinces, it was impossible to reach rural areas where people were thinly distributed over vast distances. Additionally, in a mass media culture dominated by politics, crime and sport, it was not easy to secure media interest in science-related news and events. It also proved difficult to make science interesting and relevant to people who had to deal with unemployment and poverty in their daily lives. These challenges were compounded by the fact there were very few scientists who could speak to people in any of the country's indigenous languages. Collectively, the science communication community in the country had very little experience of how to communicate science effectively with diverse public audiences, and hardly any knowledge of catering for audiences who were mostly distant from science.

In many of the public events during YEAST'98, a disconnect between what was on offer (i.e. exhibitions and public talks) and the needs/interests of the audiences in attendance was painfully obvious.

5. Indigenous knowledge systems and pseudoscience—distinctions and overlaps

Since coming to power in 1994, the ‘new’ South African government has been committed to preserving, protecting and promoting indigenous knowledge systems (IKS). In 2004, the cabinet adopted an Indigenous Knowledge Systems Policy, and the 2016 Protection, Promotion, Development, and Management of Indigenous Knowledge Systems Bill was approved by parliament. These policies affirm African cultural values in the face of globalisation, support for services provided by traditional healers and recognition of their contribution to the economy, and the interface between indigenous knowledge systems and other forms of knowledge.

The National Research Foundation (NRF) provides funding for research into IKS-based innovations and the links between IKS and bioeconomy, astronomy, food security, farming, environment, storytelling and music, as well as for exploring women’s roles in IKS and the IKS practices amongst specific communities such as the Khoi, Nama, Griqua and San.

A 2009 national survey demonstrated that the majority of South Africans favour indigenous knowledge over so-called ‘Western science’ (HSRC, 2010). Two-thirds (66 per cent) of respondents felt that IKS could offer lessons that could benefit everyone and 71 per cent felt that South Africans trusted too much in science and not enough in indigenous knowledge. However, claims that up to 80 per cent of South Africans regularly use traditional healers have been shown to be incorrect (Wilkinson, 2013). A 2008 survey shows that only 1.2 per cent of South African households consult traditional healers (Nxumalo et al., 2011), while a 2014 study reports that only 0.5 per cent of South Africans see traditional healers as a first point of call for health services (Statistics South Africa, 2015). Nonetheless, traditional healers are regarded as custodians of indigenous knowledge and form part of the local healthcare system. While some traditional healers collaborate with scientists to validate the healing properties of certain plants (Makunga et al., 2008; Ramchundar and Nlotoo, 2017), others regard their declared healing powers as closely guarded secrets (Ndhlala et al., 2011). Some healers claim that their therapies cannot be scientifically tested, since their healing powers are at least partially of a spiritual nature. For these healers, subjecting these cures to scientific scrutiny could be conceived as being insensitive to their ancestors, who they consult in their healing practices.⁹

9 Presentation by Janice Limson at SciCOM100 Conference, Stellenbosch University, 5 November 2018.

A key concern around traditional healers relates to those who pose as herbalists but offer dubious remedies and propagate potentially harmful beliefs (Ndhlala et al., 2011; Nyundu and Naidoo, 2016). Examples of damaging myths and superstitions include trust placed in the magical powers of *muthi*¹⁰ to protect during conflict (Nyundu and Naidoo, 2016); the belief that lightning is caused by witchcraft (Le Grange, 2007); the belief that sex with a virgin is a cure for HIV/AIDS (Pitcher and Bowley, 2002); and the stigma associated with people living with albinism (Baker et al., 2010). In extreme cases, human remains are used for *muthi* (Ndhlala et al., 2011). Traditional healers' use of animal parts, including lions, vultures and reptiles, are mostly for pseudotherapeutic effects such as making someone stronger, boosting luck or warding off bad spirits, but these practices raise conservation concerns (Ndhlala et al., 2011; Williams and Whiting, 2016). The problems that result from such myths and superstitions are widely recognised (Manzini, 2003), as is the need to eliminate outdated and potentially damaging practices (Du Plessis, 2017).

A notable illustration of the consequences of pseudoscientific beliefs can be found in an incident that occurred in South Africa around the year 2000 when Thabo Mbeki, South African president at the time, questioned the science of HIV/AIDS. Together with his health minister, Dr Mantombazana Tshabalala-Msimang, they promoted the use of the African potato and a concoction of garlic, beetroot and lemon as an HIV/AIDS treatment (Schneider and Fassin, 2002; Mbali, 2004; Nattrass, 2007). The subsequent delay in implementing an antiretroviral treatment regime in the public health system led to the deaths of more than 330,000 people, while about 35,000 HIV-positive babies were born during this period (Chigwedere et al., 2008).

Some scientists perceive a particular duty to speak out against these pseudoscientific beliefs (Joubert, 2018b), but it is a complex issue that requires sensitivity to local sociocultural dynamics. These beliefs are deeply connected to local cultures and their traditional way of life (Williams and Whiting, 2016) and may be linked to deep-rooted suspicions of so-called 'white' medicine (Batts, 2006).

Current debates on the 'decolonisation' of South African universities are closely related to an increasing awareness of the science information needs of local communities in the context of IKS. Scholars are currently exploring ways in which so-called 'Western' science and indigenous knowledge might be integrated. The implications and challenges of such an integration for public science engagement are obvious and numerous.

10 *Muthi* is a plant- or animal-based substance prepared by herbalists that is believed to heal, cleanse, strengthen or protect.

6. A new policy environment

Because of its defining role in policy and funding, government is a pivotal role player in public science engagement in South Africa. Current science policies, including new legislation, white papers and long-term strategic plans, demonstrate that policymakers see public engagement as a tool to democratise science, increase the societal impact of science and sustain public trust in science. In its 2019 White Paper on Science, Technology and Innovation (DST, 2019), the South African Department of Science and Technology (DST) reiterates the importance of a science-literate and science-aware society. Public engagement with science is regarded as a prerequisite for South Africa to become a knowledge-based society with a participatory mode of science governance. Citizens are no longer passive recipients of the products of science, but important contributors to the processes that shape science (DST, 2007, 2015). These policy intentions are consistent with global trends in science communication emphasising a transition from top-down, one-way communication towards a participatory mode of engagement. However, as elsewhere, the implementation of truly dialogic science engagement is complex and challenging. At present, most science engagement activities—with their emphasis on public talks, exhibitions and workshops—would fall into the category of providing information to a captive audience.

In 2015, the DST adopted a *Science Engagement Strategy* (DST, 2015), positioning science engagement as a way to enrich people's lives and empower them to reflect critically on issues rooted in science. This framework spells out wide-ranging plans to support, coordinate and evaluate science engagement at a national level, and proposes that public science engagement should become a mandatory activity for publicly funded researchers. These new policy intentions are confirmed in the 2019 White Paper (DST, 2019), including the intention of allocating a fixed percentage of public research funding to raising science awareness.

Three years since the announcement of this new engagement strategy, there is still a wide gap between these ambitious aims and the grassroots realities of public science engagement in South Africa. Key challenges relate to the multitude of target audiences, the dual nature of its objectives, the question of effective evaluation and the lack of tangible incentives for scientists' involvement in engagement activities.

It is evident that government paints with a very broad brush when identifying target audiences for public science engagement. The new strategy goes some way towards segmenting audiences. However, 11 target publics, namely learners, educators, industry, scientists and researchers, science interpreters, decision makers, journalists, students, tourists and indigenous knowledge holders, are still listed, with ‘the general public’ added as a catch-all category. Such broad and vague descriptions of audiences for science communication are problematic, since trying to engage everyone typically results in engagement programs that are superficial and impossible to evaluate, and may not be particularly effective for any specific audience (Borchelt, 2001). Scholars (e.g. Irwin and Horst, 2016) warn against the conflation of different publics into a generic whole. Furthermore, science communication activities aimed at ‘the general public’ are likely to connect with publics that are already interested, socially privileged and/or positively predisposed towards science at the expense of ‘hard-to-reach’ and marginalised groups in society (Kennedy et al., 2017; Dawson, 2018).

The current science engagement strategy of government proposes a blend of promotional, educational and engagement goals, using terms such as ‘popularise’, ‘promote’ and ‘profile’, which are reminiscent of a marketing/PR approach and deficit-style communication. In contrast with these aims, the strategy also specifies the development of a socially aware and critical society concerning matters of science and technology. The White Paper similarly frames the objectives of public science engagement activities as promoting science and ‘enhancing its public standing’ (DST, 2019, p. 33).

It is problematic to assume, as stated by government, that science will become popular amongst South Africans ‘if all target publics participate in projects that make them aware and keep them abreast of key developments in science and technology’ (DST, 2018, p. 10). In reality, more knowledge about science does not necessarily translate into more positive attitudes toward science (Cheng et al., 2008; Scheufele, 2014). In fact, scientific literacy and scientific ideology are negatively correlated in most countries, meaning that more knowledgeable citizens are more likely to reject new scientific ideas (Bauer, 2008).

Recognising the need for meaningful evaluation and impact measurement of its science engagement programs, the DST developed a comprehensive *Science Engagement Monitoring and Evaluation Framework* (DST, 2018). This framework proposes an extensive set of baseline measures and success indicators, along with the structures, processes and tools required for effective monitoring and evaluation. It will, no doubt, be challenging to implement

these evaluation measures across a fragmented system where role players are not accustomed to being evaluated in this way. A key challenge is progressing from attractively simple measures such as counting numbers of visitors at public science events, towards measures capable of evaluating whether people have gained new understanding, insights or competencies through their engagement with science at these events.

In line with global trends, research funding instruments in South Africa are attributing increasing prominence to public science engagement. Local and international funders have introduced societal impacts as one of the criteria they consider when reviewing funding proposals, indicating their intention to position public engagement as an integral part of a research plan. However, it remains unclear whether these engagement plans have any effect on funding decisions and many scientists do not see any incentives for public science engagement from their employers. Consequently, calls for increased involvement in public engagement are often perceived as lip service rather than a genuine commitment on the part of funders and institutions (Joubert, 2018b). This apparent lack of rewards remains an obstacle when it comes to motivating scientists to become—and remain—actively involved in public science engagement activities.

7. The institutionalisation of science communication in present-day South Africa

The establishment of the South African Agency for Science and Technology Advancement (SAASTA) in 2002 is evidence of the democratic government's recognition of the need to coordinate public science engagement at a national level, and to invest in related activities. SAASTA is mandated to implement the science engagement initiatives of the DST.

The science engagement initiatives of government depend on a network of museums, science centres and festivals that were pioneered by dedicated individuals ardently committed to creating innovative spaces for informal science learning. The first science centre in South Africa was established as an 'exploratorium' at the University of Pretoria in 1977 by Lötze Strauss, while Brian Wilmot launched SciFest Africa in 1996. Other notable science centre pioneers include Shadrack Mahapa, Mike Bruton, Jan Smit and Derek Fish.

Figure 32.2: Held annually in Makhanda in the Eastern Cape Province of South Africa, SciFest Africa is the largest and oldest science festival in the country where young and old can enjoy and debate science.

Source: Water World – South African Institute for Aquatic Biodiversity (used with permission).

Figure 32.3: A network of science centres across South Africa forms an important part of South Africa's science communication ecosystem, particularly for engaging school learners and hosting public engagement events such as science weeks.

Source: Arcelor Mittal Science Centre (used with permission).

Science centres cater for diverse audiences and provide vital opportunities for informal science learning. They also play a key role in supporting the school science curriculum and providing spaces where learners from under-resourced schools can do practical science experiments. These centres¹¹ vary in size and sophistication, from small and rudimentary displays crammed into tiny spaces, to modern and well-equipped centres with interactive displays and custom-built auditoria, with some mobile outreach programs to peri-urban and rural communities. One challenge they have in common is that of financial sustainability in a country where the bulk of their visitors cannot afford to pay even a modest entry fee. In addition to funding from government, some science centres rely on industry support. A relatively common local model is that science centres are built on university campuses, with some financial support provided by the hosting university.

11 The SAASTEC website lists 37 science centres in South Africa in 2018, with 59 organisations listed as SAASTEC members. See www.saastr.ec.co.za/membership/.

A few leading organisations on the local science landscape have adopted projects that focus on promoting public engagement with science. For example, the National Science and Technology Forum (NSTF) recognises top achievers in science at its annual 'NSTF-South32 Awards', with a special category for science communicators. The Academy of Science of South Africa (ASSAf) publishes a quarterly popular science magazine called *Quest*.

Several NGOs also make a significant contribution to engaging the South African public in science and conservation issues, including the Endangered Wildlife Trust (EWT), Birdlife Africa, the Wildlife and Environment Society of South Africa (WESSA) and the World Wide Fund for Nature South Africa (WWF SA). Citizen science projects scattered across the country allow thousands of volunteers to collect data on birds, butterflies, insects, spiders, frogs and mammals that feed into various science and conservation projects. For example, the Animal Demography Unit at the University of Cape Town uses citizen-generated data to create a series of atlases that feed into conservation policies, as well as a dynamic virtual (online) museum. Similarly, the National Biodiversity Institute and South African National Parks uses its network of botanical gardens and nature reserves as starting points for involving visitors in citizen science.

A notable development on the local science communication scene is the blending of science centres and tourism interests, with Maropeng and the Sterkfontein Caves, and the official visitor centres for the Cradle of Humankind World Heritage Site, as premier examples. Here, interactive displays chart the progress of humankind from our early beginnings in Africa, focusing on the science of palaeoanthropology and what it represents in terms of understanding our shared heritage and common humanity.

Today, South African scientists are increasingly visible on the local and international stage via their participation in science communication events and competitions such as FameLab, Three-Minute-Thesis and Pint of Science (Garrard, 2018), and at science cafés that regularly pop up on university campuses. Another creative science engagement platform that has spilled over to South Africa is Science & Cocktails organised at the Orbit Jazz club in Johannesburg since 2015. More examples of science-collaborations include Science Lens, a science photography competition organised by SAASTA since 2002, as well as the SKA (Square Kilometre Array) Shared Sky project that brought together South African and Australian artists in a collaborative exhibition on ancient cultural wisdom about the understanding of the night sky.

Figure 32.4: The potential of music and dance in engaging previously ‘hard-to-reach audiences’ with science is increasingly being realised. Hip hop in particular presents a unique opportunity to connect with underprivileged youth and make science relatable. This image showcases a Hip Hop U event facilitated by Jive Media Africa and the African Health Research Institute. Through such initiatives, science, hip hop and music are being combined in creative and entertaining ways.

Source: African Health Research Institute (used with permission).

8. Science journalism in South Africa

Nearly 70 per cent of South Africans rely on radio to find out about science; 65 per cent get science information from free-to-air television, while online sources are still relatively unimportant (Parker, 2017). In recognition of the importance of radio as a channel for public science engagement in the country, SAASTA has launched an initiative to place young, unemployed science and journalism graduates at community radio stations to increase good science content via community radio.

As in other countries, the number of specialist science reporters in South Africa has declined, raising concerns about the scope and quality of science journalism in the country. These include haphazard science reporting by untrained journalists and a blurring of science and pseudoscience in media reports (Claassen, 2011). Still, while science-focused pages in print media and programs on television and radio are rare, science does feature in mainstream print media as well as in actuality and investigative programs on radio and television. For example, *Carte Blanche*, a weekly, hour-long television program that celebrated its 30th anniversary in 2018, regularly features stories related to science, health and/or the environment. Local health journalism has been given a lifeline in the form of a donor-funded platform called Bhekisisa.

Furthermore, since its launch in 2015, the Africa edition of *The Conversation* offers a new intermediary platform for researchers to write for the mass media and general public.

Science media coverage in South Africa has some unique fingerprints that reflect issues of local importance and geographical relevance. For example, the media pays most attention to issues related to HIV/AIDS and education, topical environmental issues such as rhino poaching (Guenther, Weingart and Joubert, 2019) and large science infrastructure projects such as the SKA project (Gastrow, 2015).

9. Establishing science communication research and university training

Since the early 1990s, a handful of South African researchers started looking at public understanding of and attitudes to science—mostly attributing low levels of understanding and interest to the legacy of apartheid (e.g. Pouris, 1991, 1993, 2003; Blankley and Arnold, 2001). As Du Plessis and Masilela (2012) pointed out, these studies were primarily small and demarcated, highlighting the need for more nuanced and comprehensive assessments of the relationship between South African science and its publics. More recently, the Human Sciences Research Council (HSRC) has commissioned nationally representative surveys of the public's perceptions of science (Reddy et al., 2013), as well as public perceptions of astronomy and the SKA telescope (Roberts et al., 2014) and public perceptions of biotechnology (Gastrow et al., 2018). Investigations into representations of science in the media focused on biotechnology (Gastrow, 2010) and the SKA telescope (Gastrow, 2017). These studies reveal a complex mixture of perceived benefits and reservations in the way South Africans view science (Reddy et al., 2013; Guenther and Weingart, 2016) and highlight the influence of culture and cultural distance to science when interpreting public views of science, particularly for rural communities (Guenther and Weingart, 2018; Guenther et al., 2018). Research by Parker (2017) reveals a bleak overall picture of low interest in science and very few South Africans involved in activities where they could engage with science.

As local science communication policy changed in favour of public science engagement, a community of science communication practitioners emerged and expanded, but academic activity was still largely neglected (Du Plessis, 2017). In 2015, two research chairs in the field of science communication were established in South Africa, one each at Stellenbosch and Rhodes

universities. Research at Stellenbosch focuses on the challenges of engaging a culturally diverse and educationally stratified society. The research agenda includes work on public perceptions and expectations of science, science as reflected in the mass media, the role of scientists and scientific organisations, and the influence of social media on science and science communication. The research team at Rhodes studies models of direct engagement between scientists and the public while exploring the benefits of science engagement to science students—and in particular their motivations for conducting research that has direct societal impact and co-creates knowledge with local communities. The work of these two research groups generates an evidence base for public science engagement within the local context, responding to the unique socioeconomic challenges and social stratifications that characterise South Africa.

South African science communication scholars and communicators participate in several international projects relevant to science communication. In 2011, the International Astronomy Union (IAU) decided to locate their international Office of Astronomy for Development (OAD) in Cape Town. South Africa joined the UK, Germany, China and India in the Mapping the Cultural Authority of Science (MACAS) project during 2012–15, with the aim of constructing a system of science culture indicators based on news analysis and public attitude data. The research outputs from this project are collected in a book, *The Cultural Authority of Science: Comparing across Europe, Africa, Asia and the Americas* (Bauer et al., 2019). South Africa is one of 14 countries participating in New Understanding of Communication, Learning and Engagement in Universities and Scientific Institutions (NUCLEUS), a Horizon 2020 project. Furthermore, the South African Institute for Aquatic Biodiversity (SAIAB), a business unit of the NRF, has been selected as an ‘embedded nucleus’ or test site for responsible research and innovation. The focus is on ‘engaged’ research—i.e. integrating meaningful and mutually beneficial dialogue with lay people into the research agenda.

10. Ongoing science communication challenges

South Africa is one of the most unequal societies in the world, with millions of people living in impoverished circumstances. For them, daily needs such as clean water and having enough food to eat are paramount, while debates about genetically modified organisms or nuclear energy seem superfluous (Lewenstein et al., 2002).

Figure 32.5: The construction of several components of the Square Kilometre Array in a central part of South Africa has provided a platform for engagement with local communities. Astrophysicist Dr Nadeem Oozeer explains how a radio telescope works to learners from Carnarvon Primary School.

Source: South African Radio Astronomy Observatory (used with permission).

Several of South Africa's 'big science' installations, such as the Southern African Large Telescope (SALT) and the SKA, are located in rural areas in close proximity to towns riddled with unemployment and other social problems. These super-sized telescopes are built to explore the evolution of the universe and the nature of black holes and dark matter. Understandably, people may question the need for these mega-investments from the public purse. Acknowledging that people in Africa have far more pressing challenges than exploring the universe, local scholars and communicators argue that astronomy is uniquely positioned to foster socioeconomic development and address developmental challenges in marginalised communities (McBride et al., 2018). Under these conditions, one can make a strong moral case for scientists to engage with disadvantaged communities (Manzini, 2003) and many local scientists perceive particularly strong duty to help improve people's lives (Joubert, 2018b).

In South Africa, school-level education¹² is plagued by problems such as underqualified and demotivated teachers, as well as poorly resourced or dysfunctional schools. In an effort to help address a huge science and mathematics education backlog, the bulk of publicly funded science communication initiatives target school-going youth and educators. For example, more than 70 per cent of participants in National Science Week and visitors to science centres are school learners (DST, 2015). This means that science engagement activities rarely cater for people beyond school-going age, limiting their ability to foster broad engagement with science. Language barriers cause a further disconnect between students and the science curricula taught at school. While the benefits of presenting science engagement activities in learners' home languages have been shown (Fish et al., 2017), South Africa lacks the capacity to deliver multilingual science engagement programs. Furthermore, the lack of a vocabulary that captures phenomena such as 'climate change' or 'genetically modified organisms' in the local vernacular is problematic.

11. Conclusion

The initial years of democracy were an optimistic time in South Africa, with high hopes for a unified 'rainbow nation' and prosperity that would spill over into a continent-wide African Renaissance. But, given the historical disconnects between science and the majority of South African citizens, along with huge socioeconomic disparities, the challenges of creating a scientifically literate society were vastly underestimated. Progress was derailed by inexperience with such challenges and misguided politics. Already monumental challenges were compounded by the intricacies of balancing the interests of indigenous knowledge systems (not including harmful superstitions) and modern science.

Despite these shortcomings, public communication of science in South Africa has made significant strides since the period when science was strategically isolated from the majority of its citizens. Currently, there is growing support for creating new connections between science and diverse audiences. Many role players in the local science ecosystem have taken up the challenge of making science publicly visible and accessible and engaging people in mutually beneficial dialogue. A solid start has been made with establishing science communication as a field of research and teaching in the country.

12 The dire state of mathematics education, for example, is revealed in the 2015 Trends in International Mathematics and Science Study (TIMSS) with Grade 4 learners in South Africa rated 49th out of 50 participating countries (Mullis et al., 2015).

Scientists are inspired to share their work by the country's unique fossil record, the ubiquitous access to the African night sky and rich biodiversity (Joubert, 2018b). It is therefore not surprising that palaeontologists,¹³ astronomers¹⁴ and health researchers¹⁵ are amongst the most active science popularisers in the country.

It has to be acknowledged that science communication policies and strategies remain largely aspirational, with limited expertise and fragmented capacity in place to implement the government's ambitious plans. Even today, science engagement activities are mostly located in urban areas, usually limited to English and predominantly geared toward children of school-going age. They cannot hope to reach nearly 60 million citizens spread over vast rural areas, speaking 11 official languages and many more local dialects. Inadequate resources and the lack of appropriate metrics to evaluate communication programs remain key challenges, along with cultural and language barriers.

In present-day South Africa, there are specific factors that motivate scientists to engage with society. These include a desire to amend for past inequalities and improve the lives of people battling with poverty and disease.

Twenty-six years since the advent of democracy, it remains questionable what progress we have made in developing an appropriate science communication infrastructure that adequately responds to local needs and would be able to deliver a truly science-engaged knowledge society. We have made a solid start, but we have a very long way to go.

13 Palaeontologists who have made their mark in public communication include Robert Broom (1866–1951), Raymond Dart (1893–1988) and Bob Brain (1931–). More recently, Francis Thackeray has been instrumental in numerous exhibitions in South Africa and around the world, focused on South Africa's fossil heritage and human evolution. Another driving force in palaeontology outreach is Anusuya Chinsamy-Turan, who has written some of the first popular books on African fossils. Known for his innovative use of social media platforms and storytelling abilities, palaeontologist Lee Berger is currently one of the most visible scientists in South Africa (Joubert and Guenther, 2017).

14 Tony Fairall (1943–2008) and Mike Gaylard (1952–2014) stand out for their exceptional contributions to astronomy outreach in the past, while people like Claire Flanagan, Matie Hoffman and Kevin Govender continue the work of using astronomy to enlighten public audiences and promote social inclusion in science. Cosmologist Thebe Medupe played a key role in producing *Cosmic Africa*, a film that presents a panorama of the mythical and practical interaction of Africa's people and the African night sky.

15 Health research, and in particular HIV/AIDS and tuberculosis (TB), are hot topics in South Africa. Researchers known for their proactive media and public engagement, include Kelly Chibale, Tebello Nyokong, Baveshe Kana, Linda-Gail Bekker and Glenda Gray.

Figure 32.6: South Africans are keenly interested in the country's rich fossil heritage and palaeontologists play a leading role in engaging with society. Professor Francis Thackeray has a dream of putting a replica of 'Mrs Ples' in every classroom in the country. 'Mrs Ples', *Australopithecus africanus*, is a distant relative of all humankind, more than 2 million years old, from the Sterkfontein Caves in South Africa.

Source: Jose Braga.

Acknowledgements

The authors wish to thank the following people for their advice, comments and suggestions: Ina Roos, Francis Thackeray, Johann Mouton, Mike Bruton, Derek Fish, Beverley Damonse, Michael Gastrow, Nelius Boshoff, Lindsay Marshall and Karien Joubert.

References

Baker, C., Lund, P., Nyathi, R. and Taylor, J. (2010). The myths surrounding people with albinism in South Africa and Zimbabwe. *Journal of African Cultural Studies*, 22(2), 169–81. doi.org/10.1080/13696815.2010.491412.

- Batts, S. (2006). Traditional African potion as AIDS 'cure'? (No, just Woo). *Science Blogs*. Retrieved from scienceblogs.com/retrospectacle/2006/08/23/traditional-african-potion-as-1/.
- Bauer, M. (2008). Paradigm change for science communication: Commercial science needs a critical public. In D. Cheng, M. Claessens, T. Gascoigne, J. Metcalfe, B. Schiele and S. Shi (eds), *Communicating science in social contexts: New models, new practices* (pp. 7–27). Berlin: Springer. doi.org/10.1007/978-1-4020-8598-7_1.
- Bauer, M., Pansegrau, P. and Shukla, R. (2019). *The cultural authority of science: Comparing across Europe, Asia, Africa and the Americas*. London: Routledge. doi.org/10.4324/9781315163284.
- Blankley, W. and Arnold, R. (2001). Public understanding of science in South Africa: Aiming for better intervention strategies. *South African Journal of Science*, 97(3/4), 65–69.
- Borchelt, R.E. (2001). Communicating the future: Report of the Research Roadmap Panel for Public Communication of Science and Technology in the Twenty-first Century. *Science Communication*, 23(2), 194–211. doi.org/10.1177/1075547001023002006.
- Boshoff, S. C., Grebe, E., Mouton, J., Ravat, E., Ravjee, N. and Waast, R. (2000). *Science in South Africa: History, institutions and statistics*. Stellenbosch: Centre for Interdisciplinary Studies (CREST), Stellenbosch University, Stellenbosch.
- Bruton, M. (2015). *When I was a fish: Tales of an Ichthyologist*. Johannesburg: Jacana Media.
- Bruton, M. (2016). *Traditional fishing methods of Africa*. Cape Town: Cambridge University Press.
- Bruton, M. (2017). *The annotated Old Fourlegs: The story of the coelacanth*. Cape Town: Penguin Random House.
- Bruton, M. (2018). *The fishy Smiths: A biography of JLB & Margaret Smith*. Cape Town: Penguin Random House.
- Carruthers, J. (2008). Scientists in society: The Royal Society of South Africa. *Transactions of the Royal Society of South Africa*, 63(1), 1–30. doi.org/10.1080/00359190809519207.
- Cheng, D., Claessens, M., Gascoigne, T., Metcalfe, J., Schiele, B. and Shi, S. (eds) (2008). *Communicating science in social contexts: New models, new practices*. Berlin: Springer. doi.org/10.1007/978-1-4020-8598-7.
- Chigwedere, P., Seage, G. R., Gruskin, S., Lee, T. H. and Essex, M. (2008). Estimating the lost benefits of antiretroviral drug use in South Africa. *Journal of Acquired Immune Deficiency Syndromes*, 49(4), 410–15. doi.org/10.1097/QAI.0b013e31818a6cd5.

- Claassen, G. (2011). Science and the media in South Africa: Reflecting a 'dirty mirror'. *Communicatio*, 37(3), 351–66. doi.org/10.1080/02500167.2011.622288.
- DACST. (1996). *White Paper on Science and Technology*. Pretoria: Department of Arts, Culture, Science and Technology. Government Printers.
- DACST. (1998). *The South Africa Report, The Year of Science and Technology*. Pretoria: Department of Arts, Culture, Science and Technology. Government Printers.
- DACST. (1999). *Annual Report*. Pretoria: Department of Arts, Culture, Science and Technology. Government Printers.
- DACST. (2000). *Annual Report*. Pretoria: Department of Arts, Culture, Science and Technology. Government Printers.
- Dawson, E. (2018). Reimagining publics and (non)participation: Exploring exclusion from science communication through the experiences of low-income, minority ethnic groups. *Public Understanding of Science*, 27(7), 772–86. doi.org/10.1177/0963662517750072.
- DST. (2007). *Innovation towards a knowledge-based economy: Ten-year plan for South Africa (2008–2018)*. Pretoria: Department of Science and Technology. Government Printers.
- DST. (2015). *Science Engagement Strategy*. Pretoria: Department of Science and Technology. Government Printers.
- DST. (2018). *Science Engagement Monitoring and Evaluation Framework*. Pretoria: Department of Science and Technology. Government Printers.
- DST. (2019). *White Paper on Science, Technology and Innovation*. Pretoria: Department of Science and Technology. Government Printers.
- Du Plessis, H. (2015). The media and science communication: Exploring the complexity of communicating science in South Africa. *China Media Research*, 11(1), 46–54.
- Du Plessis, H. (2017). Politics of science communication in South Africa. *Journal of Science Communication*, 16(3), A03. doi.org/10.22323/2.16030203.
- Du Plessis, H. and Masilela, T. (2012). Report on the Human Sciences Research Council (HSRC) 2012 Conference – The Re-emergence of Astronomy in Africa – A Transdisciplinary Interface of Knowledge Systems. *Journal of Scientific Temper*, 1(3&4), 219–26.
- Dubow, S. (2006). *A commonwealth of knowledge: Science, sensibility and white South Africa 1820–2000*. New York: Oxford University Press.
- Fish, D., Allie, S., Pelaez, N. and Anderson, T. (2017). A cross-cultural comparison of high school students' responses to a science centre show on the physics of sound in South Africa. *Public Understanding of Science*, 26(7), 806–14. doi.org/10.1177/0963662516642725.

- Garrard, C. (2018). Pint of Science: Bringing science to the public and highlighting African research. *South African Journal of Science*, 114(7/8), Art. #a0280. doi.org/10.17159/sajs.2018/a0280.
- Gastrow, M. (2010). *The public understanding of biotechnology in the media: A report for the National Advisory Council on Innovation and the National Biotechnology Advisory Committee*. Pretoria: Human Sciences Research Council.
- Gastrow, M. (2015). Science and the social media in an African context: The case of the Square Kilometre Array telescope. *Science Communication*, 37(6), 703–22. doi.org/10.1177/1075547015608637.
- Gastrow, M. (2017). *The stars in our eyes: Representations of the Square Kilometre Array telescope in the South African media*. Pretoria: HSRC Press.
- Gastrow, M., Roberts, B., Reddy, V. and Ismail, S. (2018). Public perceptions of biotechnology in South Africa. *South African Journal of Science*, 114(1/2), Art. #2017-0276. doi.org/10.17159/sajs.2018/20170276.
- Guenther, L. and Weingart, P. (2016). A unique fingerprint? Factors influencing attitudes towards science and technology in South Africa. *South African Journal of Science*, 112(7), 8–11. doi.org/10.17159/sajs.2016/20160093.
- Guenther, L. and Weingart, P. (2018). Promises and reservations towards science and technology among South African publics: A culture-sensitive approach. *Public Understanding of Science*, 27(1), 47–58. doi.org/10.1177/0963662517693453.
- Guenther, L., Weingart, P. and Joubert, M. (2019). Bridging a gap? Mapping the science coverage of South African newspapers. In M. W. Bauer, P. Pansegrau and R. Shukla (eds), *The cultural authority of science: Comparing across Europe, Asia and the America* (pp. 122–36). New York: Routledge. doi.org/10.4324/9781315163284-8.
- Guenther, L., Weingart, P. and Meyer, C. (2018). ‘Science is everywhere, but no one knows it’: Assessing the cultural distance to science of rural South African publics. *Environmental Communication*, 12(8), 1046–61. doi.org/10.1080/17524032.2018.1455724.
- HSRC. (2010). *South African Social Attitudes Survey 2009*. Pretoria: Human Sciences Research Council.
- Huigen, S. (2009). *Knowledge and colonialism: Eighteenth-century travellers in South Africa*. Leiden: Brill. doi.org/10.1163/ej.9789004177437.i-314.
- Irwin, A. and Horst, M. (2016). Communicating trust and trusting science communication: Some critical remarks. *Journal of Science Communication*, 15(6), L01. doi.org/10.22323/2.15060101.

- Joubert, M. (2018a). Reflections on the first human heart transplant and its impact on medicine, media and society. *Public Understanding of Science*, 27(1), 110–14. doi.org/10.1177/0963662517738619.
- Joubert, M. (2018b). Factors influencing the public communication behaviour of publicly visible scientists in South Africa (PhD thesis). Stellenbosch University, Stellenbosch.
- Joubert, M. and Guenther, L. (2017). In the footsteps of Einstein, Sagan and Barnard: Identifying South Africa's most visible scientists. *South African Journal of Science*, 113(11/12). doi.org/10.17159/sajs.2017/20170033.
- Kennedy, E. B., Jensen, E. A. and Verbeke, M. (2017). Preaching to the scientifically converted: Evaluating inclusivity in science festival audiences. *International Journal of Science Education, Part B*, 8(1), 14–21. doi.org/10.1080/21548455.2017.1371356.
- Le Grange, L. (2007). Integrating western and indigenous knowledge systems: The basis for effective science education in South Africa? *International Review of Education*, 53, 577–91. doi.org/10.1007/s11159-007-9056-x.
- Lewenstein, B. V., Joubert, M. and Radin, J. (2002). Achieving public understanding of research in developing countries. PCST 2002 workshop report. Cape Town.
- Logan, C. (2003). *Celebrity surgeon: Christiaan Barnard – A life*. Johannesburg: Jonathan Ball Publishers.
- Makunga, N. P., Philander, L. E. and Smith, M. (2008). Current perspectives on an emerging formal natural products sector in South Africa. *Journal of Ethnopharmacology*, 119(3), 365–75. doi.org/10.1016/j.jep.2008.07.020.
- Manzini, S. (2003). Effective communication of science in a culturally diverse society. *Science Communication*, 25(2), 191–97. doi.org/10.1177/1075547003259432.
- Mbali, M. (2004). AIDS Discourses and the South African state: Government denialism and post-apartheid AIDS policy-making. *Transformation: Transformation Critical Perspectives on Southern Africa*, 54(1), 104–22. doi.org/10.1353/trn.2004.0023.
- McBride, V., Venugopal, R., Hoosain, M., Chingozha, T. and Govender, K. (2018). The potential of astronomy for socioeconomic development in Africa. *Nature Astronomy*, 2, 511–14. doi.org/10.1038/s41550-018-0524-y.
- Molloy, B. (1992). I went to the crucifixion. In D. Cooper (ed.), *Chris Barnard by those who know him* (pp. 240–53). Cape Town: Vlaeberg.
- Mouton, J. (2006). Science for transformation: Research agendas and priorities in South Africa. In L. Box and R. Engelhard (eds), *Science and Technology policy for development, dialogues at the interface*. London: Anthem Press.

- Mullis, I. V. S., Martin, M. O., Foy, P. and Hooper, M. (2015). *Trends in International Mathematics and Science Study (TIMSS)*. Boston: TIMSS & PIRLS International Study Center. doi.org/10.1007/978-94-007-2150-0_515.
- Nattrass, N. (2007). *Mortal Combat: AIDS denialism and the struggle for antiretrovirals in South Africa*. Scottsville: University of KwaZulu-Natal Press.
- Ndhhlala, A. R., Stafford, G. I., Finnie, J. F. and van Staden, F. (2011). Commercial herbal preparations in KwaZulu-Natal, South Africa: The urban face of traditional medicine. *South African Journal of Botany*, 77, 830–43. doi.org/10.1016/j.sajb.2011.09.002.
- Noble, R. (1860). Editorial. *Cape Monthly Magazine*, 7, 130.
- Nxumalo, N., Alaba, O., Harris, B., Chersich, M. and Goudge, J. (2011). Utilization of traditional healers in South Africa and costs to patients: Findings from a national household survey. *Journal of Public Health Policy*, 32(Suppl. 1) S124–S136. doi.org/10.1057/jphp.2011.26.
- Nyundu, T. and Naidoo, K. (2016). Traditional healers, their services and the ambivalence of South African youth. *Commonwealth Youth and Development*, 14(1), 144–55. doi.org/10.25159/1727-7140/1799.
- Parker, S. (2017). Development of Indicators for the Measurement of the South African Publics' Relationship with Science (PhD thesis). Stellenbosch University, Stellenbosch.
- Pitcher, G. and Bowley, D. (2002). Infant Rape in South Africa. *The Lancet*, 359(9303), 274–75. doi.org/10.1016/S0140-6736(02)07532-3.
- Pouris, A. (1991). Understanding and appreciation of science by the public in South Africa. *South African Journal of Science*, 87(7), 358–59.
- Pouris, A. (1993). Understanding and appreciation of science among South African teenagers. *South African Journal of Science*, 89(2), 68–69.
- Pouris, A. (2003). Assessing public support for biotechnology in South Africa. *South African Journal of Science*, 99(11–12), 513–16.
- Ramchundar, N. and Nlooto, M. (2017). Willingness of African traditional healers to collaborate with researchers to further develop their traditional medicines in Kwazulu-Natal Province of South Africa. PULA: *Botswana Journal of African Studies*, 31(1), 163–79.
- Reddy, V., Gastrow, M., Juan, A. and Roberts, B. (2013). Public attitudes to science in South Africa. *South African Journal of Science*, 109(1), 1–8. doi.org/10.1590/sajs.2013/1200.
- Ritner, S. R. (1967). The Dutch Reformed Church and Apartheid. *Journal of Contemporary History*, 2(4), 17–37. doi.org/10.1177/002200946700200404.

- Roberts, B., Struwig, J., Ngungu, M. and Gordon, S. (2014). Attitudes towards astronomy and the Square Kilometre Array (SKA) in South Africa. Tabulation report based on the 2013 round of the South African Social Attitudes Survey (SASAS) prepared for Education and Skills Development (ESD) Research Programme, Human Sciences Research Council, Pretoria.
- Scheufele, D. A. (2014). Science communication as political communication. *Proceedings of the National Academy of Sciences*, 111(Suppl. 4), 13585–92. doi.org/10.1073/pnas.1317516111.
- Schneider, H. and Fassin, D. (2002). Denial and defiance: a socio-political analysis of AIDS in South Africa. *AIDS*, 16(Suppl. 4), S45–S51. doi.org/10.1097/00002030-200216004-00007.
- Sooryamoorthy, R. (2010). Science and scientific collaboration in South Africa: Apartheid and after. *Scientometrics*, 84(2), 373–90. doi.org/10.1007/s11192-009-0106-y.
- Statistics South Africa. (2015). *General household survey 2014*. Pretoria.
- Thackeray, J. F. (2009). Darwin's interest in the natural history of the Cape: from beetles to antelope, plants and granite. *Transactions of the Royal Society of South Africa*, 64(1), 79–81. doi.org/10.1080/00359190909519241.
- Tilley, H. (2011). *Empire, development, and the problem of scientific knowledge, 1870 – 1950: Africa as a Living Laboratory*. Chicago: University of Chicago Press. doi.org/10.7208/chicago/9780226803487.001.0001.
- Tomaselli, K. G. (2002). A brief history of South African journalism, mass communication and media education. *African Communication Scholars Association*, 4(1), 111–35.
- Weingart, P. and Joubert, M. (2019). The conflation of motives of science communication – causes, consequences, remedies. *Journal of Science Communication*, 18(03), Y01. doi.org/10.22323/2.18030401.
- White, T. D. (2012). Phillip V. Tobias (1925–2012). *Science*, 337(6093), 423. doi.org/10.1126/science.1225988.
- Williams, V. L. and Whiting, M. J. (2016). A picture of health? Animal use and the Faraday traditional medicine market, *Journal of Ethnopharmacology*, 179, 265–273. doi.org/10.1016/j.jep.2015.12.024.
- Wilkinson, K. (2013). Do 80% of S. Africans regularly consult traditional healers? The claim is unproven. *Africa Check*. Retrieved from <https://africacheck.org/reports/do-80-of-south-africans-regularly-consult-traditional-healers-the-claim-is-false/>.
- Wood, B. (2012). Phillip Valentine Tobias (1925–2012). *Nature*, 487(7405), 40. doi.org/10.1038/487040a.

Timeline

Event	Name	Date	Comment
First interactive science centre established.	The Exploratorium, University of Pretoria	1977	Later renamed Sci-Enza
First national (or large regional) science festival.	SASOL Scifest	1996	Now SciFest Africa
Association of science writers or journalists or communicators established.	South African Science Communicators' Network (SASCON)	1998	No longer active
First university courses to train science communicators established.	MPhil (Science and Technology Studies); specialisation in public science engagement	2015	Stellenbosch University (the university also has a journalism program going back further)
First master's students in science communication graduation.	MPhil (Science and Technology Studies); specialisation in public science engagement, Stellenbosch University	2017	
First PhD students in science communication graduation.	Science and Technology Studies, Stellenbosch University	2018	
First national conference in science communication.	Promoting Public Understanding of Science and Technology in Southern Africa	1996	At the University of the Western Cape
A national government program to support science communication established.	Year of Science and Technology	1998	
First significant initiative or report on science communication.	Report on 'Year of Science and Technology 1998'	1999	
National Science Week founded.		2000	A government-initiated flagship science promotion project
A journal completely or substantially devoted to science communication established.	<i>Archimedes</i> , a science magazine distributed mainly to white schools, published by the (former) Foundation for Education, Science and Technology (FEST)	1959–2003	2004: <i>Quest</i> , a quarterly popular science magazine published by the Academy of Science of South Africa
First significant radio programs on science made.	<i>New Science</i> (later <i>Science Matters</i>)	1994	Presented by Christina Scott (1961–2011) on the public radio station SAFM

Event	Name	Date	Comment
First significant TV programs on science made.	<i>Die Brandkluis</i> [The Safe]	1970	Afrikaans-language science program hosted by Marinus Wijnbeek
First awards for scientists, journalists or others awarded for science communication.	Science Communication Award	2006	Awarded annually by the National Science and Technology Forum (NSTF)
PCST conference hosted in the country.	PCST-7, Cape Town	2002	
Other significant events	First Science Centre Network Conference	1995	Hosted by Unizulu Science Centre at Mtunzini, KwaZulu-Natal
	Science Centre Network formed	1996	SAASTEC (Southern African Association of Science and Technology Centres)
	First Science Centre World Congress hosted	2011	Hosted by Cape Town Science Centre in Cape Town

Contributors

Dr Marina Joubert is a senior researcher at the Centre for Research on Evaluation, Science and Technology (CREST) at Stellenbosch University.

Shadrack Mkansi is a science awareness platforms manager at the South African Agency for Science and Technology Advancement.

This text is taken from *Communicating Science: A Global Perspective*,
edited by Toss Gascoigne, Bernard Schiele, Joan Leach, Michelle
Riedlinger, Bruce V. Lewenstein, Luisa Massarani and Peter Broks,
published 2020 by ANU Press, The Australian National University,
Canberra, Australia.

doi.org/10.22459/CS.2020.32