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## Who's Moon

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The Moon has been an object of fascination since human culture first began. The dominant presence of Earth's satellite in the night sky, its regular phases and relatively-frequent eclipses make it a potent symbol of the unknown. The earliest science fiction involved tales of travel to the Moon, from the political satire of Lucian of Samosata in the second century CE, through to scientific romances at the end of the nineteenth (Verne 1865, 1869; Wells 1901). Long before the Space Race offered the prospect of turning science fiction to science fact, the Moon was inextricably linked in the popular mind with visions of space travel.

*Doctor Who* arrived on our screens in 1963, set against a cultural milieu defined in large part by the Space Race between the USSR and the United States of America. The speeches of American president John F Kennedy, in particular his famous address at Rice University (Kennedy 1962), have been likened to those of a suitor offering the Moon as a love token to their beloved (Launius 2012). It was a gift that Western culture, including the television viewers of the United Kingdom, urgently needed to restore their confidence after the perceived humiliation of early Soviet spaceflight success (Lule 1991; Barnett 2013). Kennedy's assassination, just one day before *Doctor Who*'s first broadcast, raised his stated objective for the Space Race to a national obsession in the United States and gave its achievement the status of a task undertaken *in memoriam*.

Unsurprisingly then, the Moon is a recurrent symbol in *Doctor Who* history, appearing as a setting or focus in stories from the mid-1960s through to the 2010s. This chapter explores the conceptual representations and role of Earth's Moon in *Doctor Who*<sup>1</sup> and discusses how they reflect the changing contemporary understanding of the satellite and its origin. As we stand on the brink of a new Space Age, I evaluate how the prominence of the Moon in the *Doctor Who* universe reflects its wider cultural and political significance, and how its representation is informed by popular attitudes to space. In this context, I discuss issues of ownership and sovereignty, lunar exploitation, the dark side of the Moon, the Moon as a scientific space, and the waning of the Moon as Mars waxes instead at the new frontier.

### Ownership and Sovereignty

The question of who owns the Moon has challenged philosophers and politicians alike. Is the Moon merely another territory to be conquered by the most powerful nation? Unlike territory on Earth, the challenges of reaching the lunar surface requires technical rather than military superiority. The 1960s Space Race involved the exercise of both - advanced technology driven by political ideology and under tight military control. As early as 1962, President Kennedy had warned of seeing the Moon "under a hostile flag of conquest" without ruling out

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<sup>1</sup> An exhaustive list of references to the Moon in *Doctor Who* on screen, in literature, audio, comics, annuals and other media is likely impossible to construct. Instead, illustrative examples will be discussed where appropriate.

the possibility of planting his own flag (Kennedy 1962). When the Earth's satellite was eventually reached in 1969, the claims made in this respect were carefully ambiguous: while an American flag was planted, the Apollo 11 astronauts, all military officers, made the claim "We come in peace for all mankind" rather than simply on behalf of the USA.

Representations of the Moon's sovereignty in *Doctor Who* stories from the 1960s are actually less mixed than the message sent by the Apollo 11 astronauts. The first three stories in which the Moon featured prominently all treated the Moon as a symbol of international cooperation. In "The Tenth Planet" (1966) missions to the Moon feature a West Indian astronaut, under the command of an American general, answerable to International Space Command. Similarly in "The Moonbase" (1966), which appeared soon afterwards, both the purpose (world weather control) and the personnel of the station are deliberately global. Strong accents and actors with a range of ethnicities make a clear statement that no one nation has sovereignty on the Moon. While the actors in "The Seeds of Death" (1969) are less diverse in terms of skin colour and background, the use of the Moon is still transnational: now in the role of a transportation hub transferring people and material between cities. By "Frontier in Space" (1973) the Moon's usage has changed, becoming a penal colony, but still under the auspices of a world government.

The principle of restricting space exploitation to peaceful purposes was articulated as early as 1958 (NASA, 1958; United Nations, 1962), nonetheless the Space Race had placed it clearly in the realm of disputed territory to be secured. The panic which greeted the USSR's launch of the Sputnik orbiter in 1957 reflected a very real fear that by reaching space, the Soviet Union was gaining a tactical advantage (Lule 1991; Barnett 2013). It is perhaps remarkable that through the 1960s, while the rhetoric of the Space Race focussed on ideology and supremacy, *Doctor Who* was anticipating - and implicitly advocating - a principle that only become enshrined in international law with the Outer Space Treaty (United Nations 1967). This agreement, to which the United Kingdom, United States, China and the USSR (succeeded by Russia) are all signatories, disallows territorial claims beyond Earth's atmosphere, exploitation of extra-terrestrial resources by any one nation, or the military use of space. The subsequent Moon Treaty (United Nations 1979) was more explicit still: lunar resources are the "common heritage of mankind" (article 11) and "exploration and use of the moon shall be the province of all mankind and shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development" (article 4). It is noteworthy that this treaty was not ratified by the United States, United Kingdom or any other major space power.

If, then, the Moon does not belong simply to one nation can we categorically state an alternative? Does *Doctor Who's* Moon belong equally to humanity of all nations? Certainly this is the case, as seen on screen, in the classic series. However the picture elsewhere in the *Doctor Who* Universe, in particular that emerging since the turn of the twenty-first century, is somewhat more mixed.

The Fifth Doctor novel *Imperial Moon* (Bulis, 2000) presents a rare example of *Doctor Who* confronting the issue of lunar sovereignty directly. The novel, in which a military officer leads a secret nineteenth-century British Royal Navy moon landing, employs the steampunk aesthetic and Victorian sensibilities to add colour to what might otherwise be a straightforward (albeit domed) jungle-planet story. Nonetheless, one of the first actions of the

mission is planting the Union flag and claiming the Moon for Queen and Country. This provides a context in which the officer in command can question his role as an Imperial trailblazer - although even then the question is not whether Britain above all other humanity can claim the Moon, but rather whether hypothesised native life might challenge the claim. The narrative here is primarily one of race, gender roles and imperialism, but both the rectitude and the difficulty of establishing territorial claims in the Moon's hostile environment is explored through the ultimate failure of the mission.

An unusual use of the Moon to explore issues of sovereignty occurs in the two-part Eleventh Doctor story, "The Impossible Astronaut/Day of the Moon" (2011). In this narrative, the Apollo programme is initially presented in a manner that subtly perverts its established symbolism: rather than standing as an exemplar of human courage, ingenuity and determination, it is shown to result merely from an alien requirement for invention of a space suit. Common human ownership not just of the Moon but of their own planet Earth is challenged, and shown to be illusory. It is in large part due to the effective symbolism of the Apollo programme that the resolution to this story - in which the Doctor makes use of the "One Small Step" moonwalk imagery to return humanity to independent control of their planet - is both emotionally and intellectually satisfying. As Neil Armstrong asserts humanity's ascendancy over the Moon "in peace for all mankind", every other human grasps the understanding - and weapons - required to achieve the same on Earth. An unspoken subtext is that the Doctor has not only reclaimed the Earth for humans, but also reclaimed the Moon and the Apollo landings as symbols of human achievement and sovereignty.

With military spy satellites and programmes such as the "Star Wars" Strategic Defence Initiative undermining one of the prime tenets of the Outer Space Treaty through the 1980s and 1990s, it is perhaps unsurprising that representations of the Moon's sovereign status have also become less clear cut over time. The children's novel *Dust of Ages* (Richards 2009) and television story "Kill the Moon" (2014) both suggest the Moon is being opened up for commercial exploitation, while the Eleventh Doctor novel *Apollo 23* (Richards 2010) and the audio adventure "1963: The Space Race" (Big Finish Productions, 2013) both posit an American military base concealed on the lunar surface. While lunar mining may plausibly be permitted under the Outer Space Treaty, a permanent military presence outside Earth's atmosphere certainly is not.

Perhaps the most surprising conception of lunar sovereignty appearing in the series is found in "Smith and Jones" (2007). In removing a London hospital and its occupants to the Moon, the alien Judoon are taking it to *neutral* territory. Far from recognising the rights to lunar sovereignty of any nation, or even of humanity itself, the Shadow Proclamation (the strongest judicial authority in *Doctor Who* at this epoch) consider it outside of Earth jurisdiction entirely. Surprisingly, neither the Doctor nor any human challenges this interpretation. It is perhaps indicative of the popular indifference to the Moon in the early twenty-first century that this usurpation of "the common heritage of mankind" passed without comment.

## **The Moon as a resource**

While the question of lunar sovereignty has taxed philosophers, a more practical issue since the dawn of the Space Age has been the question of the Moon's resources, and how they may be utilised. The Moon Treaty is clear that any profit derived from lunar resources must be shared with other nation states, regardless of the funding source for exploitation - however this document was never ratified by any space power, leaving the current position unclear (Hoffstadt 1994).

Commercial mining of the lunar regolith (the fine powdered rock coating the Moon's surface) could plausibly harvest materials including Helium 3, an important potential power source, as shown in the blockbuster film *Moon* (2009). However uncertainties regarding lunar ownership rights act as a discouragement for both government and private investment, since a return on investment is difficult to guarantee (Bilder 2010; Hertzfeld and von der Dunk 2005). Nonetheless, *Doctor Who's* Moon is not immune to commercial pressures. A privately-financed Mexican mineral survey is referenced in "Kill the Moon" and mineral prospecting on behalf of "the big corporations" in *Dust of Ages*. However despite these examples, lunar mineral and resource exploitation has not been a major feature of *Doctor Who*, perhaps due to the surfeit of atmosphere-rich worlds which might be more readily exploited.

Instead, the key practical utility of the Moon in the *Doctor Who* universe has been its strategic location. This is demonstrated, as already mentioned, by its use as a transportation hub (in "Seeds of Death") and as a weather control station (in "The Moonbase"). In both cases, the application relies on a crucial feature of the Moon-Earth system: tidal locking. Gravitational forces act to transfer angular momentum from spin to orbit over time, until first the less massive object in an orbiting binary and then the more massive object comes to synchronise with one face constantly turned towards its companion. The Moon is tidally locked to the Earth. The Earth is yet to lock with the Moon, but is gradually slowing in its rotation as energy is dissipated raising tides in both ocean and rock (Halley 1695; Stephenson and Morrison 1995). This property means that a site on the near side of the Moon will at all times have an entire Earth hemisphere in view. Thus, the Moon forms a natural communications satellite, and was used as such by the writers of the 1960s serials. The rise of commercially-viable artificial satellites, many in more useful geosynchronous orbits, rendered the Moon's use as an Earth-observation and communications platform redundant, and this is reflected in the absence of such stories from the *Doctor Who* canon since the 1960s.

## **The Dark Side of the Moon**

The tidal locking of the Moon also results in a lunar hemisphere which is never seen from the Earth's surface. This unobservable region has received the popular label "the dark side", where the misleading term refers to mystery rather than physical illumination (both sides of the Moon partake equally in its 709 hour day/night cycle). A similar dark side exists in the cultural symbolism of the Moon, with its influence blamed for afflictions ranging from lunacy to lycanthropy. Inevitably then, there is also a dark side to *Doctor Who's* Moon.

The Moon itself has presented a threat to life on Earth in the *Doctor Who* universe. In "The Silurians" (1970), the eponymous reptilians retreated into underground hibernation through

fear that an approaching minor planet would strip the atmosphere from Earth, rendering it uninhabitable. Instead the planetoid was captured in a terrestrial orbit, becoming the Moon. At the time this was discussed on screen the “capture hypothesis” for the Moon’s origin was widely accepted in scientific circles (Urey 1966). It wasn’t until chemical analyses of the Apollo and Russian Luna mission moon rock samples were published that the modern “giant impact hypothesis” (Hartmann and Davis 1975, Brush 1988) replaced it. The common chemical composition of the Earth’s crust and the lunar regolith requires a shared origin for the two bodies that the capture hypothesis cannot explain. It is noteworthy that, despite these scientific advances, capture has been retained as the canonical origin for the Moon in the *Doctor Who* universe, referenced in “The Hungry Earth/Cold Blood” (2009), “Dinosaurs on a Spaceship” (2012) and “Kill the Moon”.

This last episode also features a second direct danger from the Moon: gravitational disturbances and consequent natural disasters that result from an embryo attempting to hatch from the lunar interior. Given that an egg is a closed system unable to gain mass, it is difficult to find a plausible scientific interpretation of this story, as discussed later. A more folkloric but similarly implausible threat from the Moon is seen in the ability of moonlight to activate lycanthropic alien cells in “Tooth and Claw” (2006) and, in concentrated form, to destroy them. The light of the full Moon is weakened, reflected sunlight from which the blue – highest energy, and most biologically active – wavelengths have been scattered (Jones *et al.* 2013). Hence there is no known mechanism by which lunar illumination can excite intense biological activity that sunlight leaves unaffected.

A less direct threat, the use of the Moon as a beachhead or shield for alien invasion, is a frequent occurrence in the *Doctor Who* universe. The lunar surface provides a convenient location both for Earth observation and for influencing its atmosphere (as was seen in a more positive context above). The tidal locking of the Moon also leads to almost an entire hemisphere which is unobservable from Earth, but sufficiently close that any base or spacecraft sited there could receive signals from the Earth’s surface. These would have to be bounced off small, easily-overlooked communication satellites in lunar orbit, but allow a full-sized spacecraft to remain hidden. Instances of alien invasions launched from on or behind the Moon appear in stories including “The Moonbase”, “The Invasion” (1968), “The Seeds of Death”, “Attack of the Cybermen” (1985), “Silver Nemesis” (1988) and “Victory of the Daleks” (2010)<sup>2</sup>.

The use of Earth’s Moon as a site for disposal of waste products is another familiar trope from science fiction which is explored in the *Doctor Who* universe. Such a usage is certainly against the spirit, if not the language, of the Outer Space and Moon Treaties. Nonetheless, both the technical aspects (Burns *et al.* 1978) and the legal ones (Dusek 1997) have been extensively discussed. If the delivery mechanism could be rendered safe then the remoteness of the lunar surface and its absence of life offer particular advantages for nuclear waste disposal<sup>3</sup>. While this particular usage does not feature explicitly in *Doctor*

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<sup>2</sup> Four of these examples involve attacks by the Cybermen who seem irresistibly attracted to Earth’s Moon - perhaps because its use as a barrier to observation mirrors the Sun’s role in hiding Mondas from Earth, or perhaps because the otherwise-twin world of Mondas lacks a large natural satellite comparable to Earth’s.

<sup>3</sup> A balance-of-bad-alternatives judgement that provides the premise for the television series *Space: 1999* (1975-1977).

Who, a parallel disposal problem - that of human 'waste' in the form of convicted criminals or political prisoners - is a prominent feature of the serial "Frontier in Space". Here the Moon appears as a penal colony (as it also does in "Bad Wolf" (2005) and the novel *Apollo 23*), fortified by the poor survival chances of escapees leaving the prison's controlled environment. While this concept appears elsewhere in science fiction (Heinlein 1968, Baxter 2015), it attracts little serious discussion outside of the fictional realm. The prohibitive cost of such a facility and of prisoner transport cannot be justified in any realistic scenario (Jones 1992).

## **The Moon as a Scientific Space**

Unlike in other, contemporary science fiction (e.g. *Captain Scarlet*, 1969) civilian lunar colonisation has never been a major feature of the *Doctor Who* universe. A rare example is perhaps implicit in "Let's Kill Hitler" (2011), where a character refers to having studied at Luna University. A university on the lunar surface continues a narrative which positions the Moon as a space for science, rather than for military, commercial and utilitarian purposes. The Apollo missions allocated time and weight to a number of experiments carried out *in-situ* on the lunar surface and placed a lunar-ranging reflector which is still in use. The Moon also offers a powerful site for astronomical telescopes. The 15cm diameter ultraviolet telescope carried by the Chinese Chang'e 3 moon lander produced cutting-edge scientific observations (Zhu *et al.* 2016; Wang *et al.* 2015). Its small size was offset by the stable platform outside of Earth's ultraviolet-opaque atmosphere, which enabled investigations simply not possible from the Earth's surface.

While not explicitly used as an astronomical observatory, the Moon in *Doctor Who* is very much a scientific space. Both the transmat hub in "Seeds of Death" and the gravitron weather control device in "The Moonbase" are complex devices, with support crews of both technical staff and pure scientists. Indeed, the Second Doctor and his companions are explicitly introduced to physicists, astronomers, mathematicians and geologists (although curiously no meteorologists) in "The Moonbase", and the premise on which the gravitron itself operates is clearly stated: "The gravitron controls the tides. The tides control the weather. Simple, eh?". The same story includes both visual and narrative discussion of conditions on the lunar surface, including its surface gravity, the need for breathing equipment and eye protection, atmosphere-controlled and domed human environments, the effects of the long lunar day on the human biological clock, the Doppler effect and the chemistry and effect of solvents such as acetone. It is surely no coincidence that the story was written by a professional scientist: ophthalmologist Christopher "Kit" Pedler. However the willingness of the production team to commission and produce a script heavy in technical detail also reflects the often-discussed educational remit of *Doctor Who*. Nor was this an isolated example. The underlying physics behind the T-Mat in "The Seeds of Death" is less apparent than that of the Gravitron, but the story is still rich in technical terminology and prominent technician characters. The Moon in this serial provides a relatively rare setting in which companion Zoe can demonstrate her own credentials as a scientist and - a still rarer occurrence - interact with another female scientist on a technical level without intervention from male colleagues. While such conversations might plausibly have occurred in any Earth-based or human-settlement context, the isolated and technology-dependent artificial environment of the Moon provides a natural space for exploring these scientific interactions.

Not only is the Moon one of the most striking astronomical phenomena in Earth's sky, its tides have a pronounced effect on Earth itself. As a result, the process of learning about the Moon is integral to learning about Earth, and forms part of the national curriculum for primary school children in the UK (Department for Education 2015). In this context, and with imagery of the US and Russian space programmes filling television screens, it is perhaps unsurprising that the early *Doctor Who* stories took pains to make their representation of the Moon plausible and factually accurate (insofar as possible within the science fiction context). This approach was particularly explicit in the show's early years, but never entirely abandoned. Both factual and speculative articles on real-world spaceflight were regular features in the *Doctor Who* annuals published through the 1960s, 70s and 80s (e.g. BBC 1967, 1976, 1978, 1982) and have continued since the relaunch in 2005. From the inclusion of factual "Tardis Data Bank" entries in the children's book *Dust of Ages*, to an account of "The Real Apollo Missions" in the *Doctor Who Official Annual 2012* (BBC 2011), scientifically accurate information is considered important when the Moon is discussed. Overtly incorrect representation of the Moon would be apparent even to young viewers and would jar the requisite suspension of disbelief.

In this context, it is impossible to overlook the one striking counter-scientific example in recent years. "Kill the Moon" sets up an initially plausible scenario, invoking both commercial ore prospecting on the Moon and the concept that changes in the Moon's gravity are causing natural disasters on Earth. However from that point onwards, it is recklessly indifferent to scientific fact, demonstrating serious misconceptions in areas ranging from microbiology to gravitational astrophysics (see Plait 2014). In part, this may reflect the writer's focus on emotional aspects of the script and its spotlight on developing the Doctor-Clara relationship, but it is still indicative of a decline in the quality of scientific and educational representation of the Moon.

*Doctor Who* has been identified as influencing the decision-making and attitudes of its fans on scientific issues (Orthia 2019). Perhaps surprisingly, there is little evidence that *Doctor Who* episodes set on the Moon, or indeed Mars, inspired a wider interest amongst the general public in the United Kingdom. The figure opposite makes use of the Google Trends analytic tool<sup>4</sup> to evaluate whether the first broadcast of episodes which feature either world has led to any measurable increases in web browser searches for the terms "Moon" or "Mars", using the ubiquitous Google search engine. The analysis is limited to searches from

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<sup>4</sup> Google Trends assigns a score to the search frequency in each calendar month since 2004, scaled such that the maximum monthly rate in any given search (or comparison between searches) scores 100. See <https://trends.google.com> and discussion in Whitman Cobb (2015).



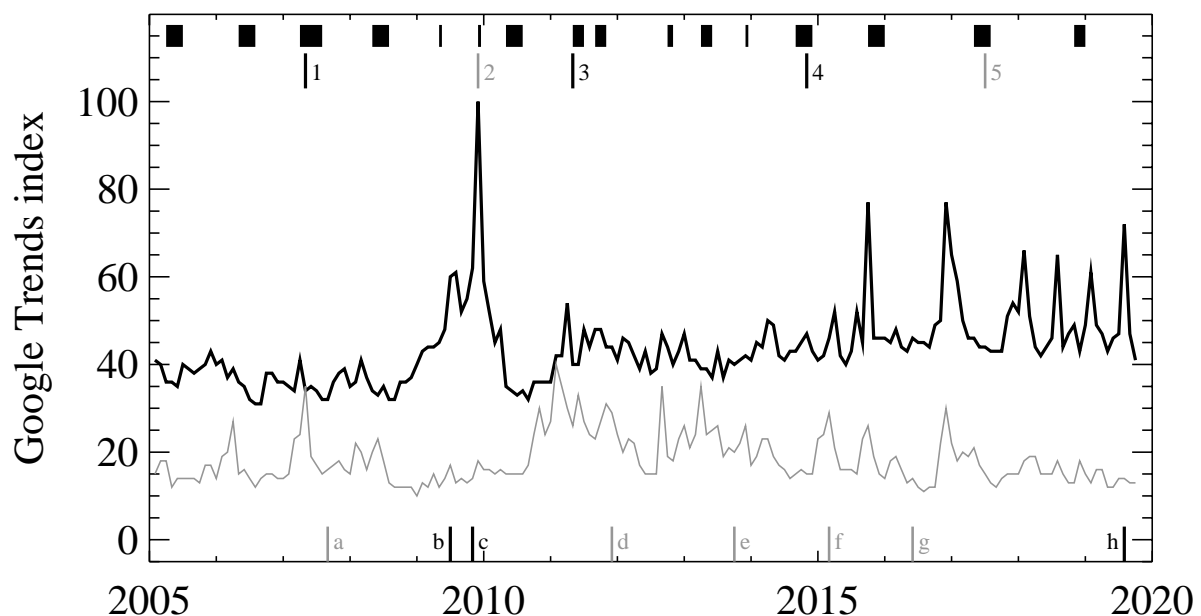


Figure: Google Trends analytics for UK searches for the terms “Moon” (black) and “Mars” (gray) over the period Jan 2004-Sep 2019. Data indicate the number of Google web searches per month, scaled such to a peak of 100. UK first transmission dates for *Doctor Who* are indicated by black bars, together with dates for five specific stories: 1) “Smith and Jones”, 2) “Waters of Mars”, 3) “The Impossible Astronaut/Day of the Moon”, 4) “Kill the Moon” and 5) “Empress of Mars”. Selected real-world events are indicated above the date axis: a) Landing of the Phoenix Rover on Mars, b) opening of 2009 movie *Moon*, c) announcement of water on Moon detected by LCROSS, d) landing of Curiosity rover on Mars, e+f) recruitment announcements by Mars One crowd-funded programme, g) SpaceX announcement of Mars plans, h) Apollo 11 50th anniversary.

the UK, in order to avoid confusion due to delayed broadcasts in other regions, and to first-time broadcasts since the relaunch of *Doctor Who* in 2005. The date of key events and press releases concerning these worlds are also indicated. As the figure demonstrates, there is no correlation between *Doctor Who* broadcasts and web searches. Indeed the only clear relation between events and searches is seen in two merged peaks dating from 2009 which mark the release of the Hollywood blockbuster *Moon* (2009) and the announcement that water ice had been detected on the lunar surface.

### The Waning Moon?

If, then, the Moon is such a prominent potential location, and such an important symbol in many different domains, why is it not used more in the *Doctor Who* Universe? The Second Doctor era of 1966-1969 featured three major stories in as many years in which the plot revolved around either a moonbase or a mission to the Moon, and another in which the Moon was used to shield invasion. By contrast, 1970s *Doctor Who* included only one story in which the Moon appeared - and then in the context of a prison planet which might plausibly have been relocated elsewhere in the Solar System. Despite the overwhelmingly Earth-based stories of the Third Doctor era and into the Fourth, there is an increasing

prominence given to stories featuring Mars, rather than the Moon, with entries including “The Ambassadors of Death” (1970) and “Pyramids of Mars” (1975). This trend continued through the prose and audio fiction of the 1990s and 2000s, with stories involving Mars far outnumbering those involving lunar settlement or exploration.

This was likely a practical and story-driven decision. The Apollo missions had drawn a firm line under the already long-discredited theory that there might be life on the lunar surface. As such any adventure set there must necessarily involve interactions between human beings rather than between humans and aliens, unless the aliens themselves were already displaced. At the same time the grey landscape of the Moon offered little visual excitement on televisions newly converted to colour. Instead, alternate locations on Earth - or hypothesized Earth-like worlds (see Eldridge, this volume) - provided scope for more interesting settings, and removed the necessity for expensive set designs and contrived explanations for Earth-like gravity.

However this shift also reflects a similar change in emphasis in military and geopolitics, as well as in the popular support - or lack thereof - for human-crewed space exploration. In both the United Kingdom and the United States “after the first Moon landing, the public rapidly became bored with the technology of space travel, and it needed a human drama such as the problems of Apollo 13 to engage their interest” (Jones 2004: 47). Support for NASA and its (very expensive) work plummeted against a backdrop of financial hardship and an easing of the Cold War in the 1970s (Roy *et al.* 2000; Launius 2003). It rapidly became clear that neither military nor commercial infrastructure on the Moon was financially viable at the then-current technology level. Despite the substantial scientific and financial benefits accrued from Apollo programme research, there was a perception that the Moon landings had done little of value beyond their initial publicity. While a majority of Americans supported the concept of further crewed space-flight, a similar majority believed that the requisite money could be better used (Roy *et al.* 2000). At the same time, probes visiting Venus and Mars raised their public profile, with the latter at least considered a promising location for both alien life and human settlement. Given the impracticality of carrying out interplanetary missions on the post-Apollo NASA (or Russian space effort) budget, crewed spaceflight was refocussed on low Earth orbit, with commercial exploitation reaching out further to geosynchronous orbit.

To a large extent, this paradigm has continued to the current time. As recently as 2008, only about 55% of respondents to a survey undertaken at a public scientific exhibition in the UK supported space exploration, with a fifth considering Mars a viable target, and no more than 2% supporting a return to the Moon (Entradas and Miller 2010). In an audience without an extant interest in science, the numbers would likely have been lower. As astronaut Lundvik told the Doctor in “Kill the Moon”: “We stopped going into space. Nobody cared.”

Paradoxically, that very statement may itself be a consequence of a new and favourable shift in attitudes toward crewed space exploration. Successive American presidents since George Bush senior in 1989 have announced initiatives involving a return to the Moon and crewed missions to Mars (although without commensurate increases in NASA funding, and all but the most recent subsequently cancelled, Launius 2012). At the same time, the development of communications and information technology has improved the potential viability of commercial exploitation of space, and empowered a generation of technically-minded

enthusiasts, entrepreneurs and philanthropists - many of whom were themselves raised on tales of the Moon landings. NASA, once the bastion of technology in the service of national interests, has engaged in a series of initiatives to recruit and encourage commercial alternatives (e.g. NASA 2019). Financial inducements have also been offered to encourage commercial lunar missions, primarily the Google Lunar X-Prize (XPrize Foundation 2019) which ran from 2007 to 2018 and generated programmes which are still ongoing (Matthew *et al.* 2019). The drive towards commercial or crowd-funded space exploitation has been termed the New Space Age - or simply “New Space” (see Pomeroy *et al.* 2019 and references therein). This landscape of private investment and minimal government regulation plays an important role in twenty-first century discourses on space exploration and has the potential to open space to countries without substantial government funding.

Legislators and legal theorists are still racing to catch up with this commercial momentum and the complex legal issues it raises (Bilder 2010; Dempsey 2014; Bruhns and Haqq-Misra 2015). Nonetheless, this image of a commercialised, highly technological future for space has become prominent in science fiction. It characterises the lunar mining operation in *Moon* (2009), and is at the root of the space debris removal attempt in *Gravity* (2013). Another example, closer to home for *Doctor Who*, can be found in the BBC’s 2005 adaptation of *The Quatermass Experiment* (originally broadcast in 1953) in which the British Experimental Rocket Group is transformed from its origins as a government organisation to a commercial entity for the twenty-first century.

While the enthusiasm over unrealistic early crowd-funding efforts (notably the Mars-One program) has ebbed (Slobadian 2015, O’Callaghan 2019), the New Space Age is far from moribund. NASA’s efforts include design studies for the Project Gateway lunar-orbital space station, and NASA and ESA have recently exhibited their completed crew capsule for the joint, moon-targeted Artemis programme. At the same time, China has landed successful rovers and probes on the lunar surface, and India came very close to achieving a soft lunar landing in the summer of 2019.

The New Space vision has been reflected in the renewed significance of both the Moon and Mars to the *Doctor Who* universe since its return in 2005. Examples of commercial exploitation of the Moon have already been discussed, while “Waters of Mars” (2009) references both national and commercial efforts to reach the red planet<sup>5</sup>. In this new paradigm, the Moon is seen as a testbed and stepping stone for future missions to Mars, and this vision was expressly articulated by *Doctor Who* in the biography of base commander Adelaide Brooke (“Waters of Mars”). The Moon itself is no longer the primary objective. Short of a “Kill the Moon”-scale spectacle, the power of our Moon to capture imaginations and attract resources is, it seems, on the wane.

Nonetheless, in the epoch of the New Space Age, *Doctor Who* is there to inform, educate and entertain, just as it was in the first Space Age. As such, a return, both to the Moon and Mars, is probable in the near-future of the Doctor, and appears increasingly possible even in the world that we, as viewers, inhabit.

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<sup>5</sup> The audio drama “Red Dawn” (Big Finish Productions 2000) represents a relatively early example of this trope.

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