Deep Space Explorers: the Cultural Legacy and Historical Memory of Pioneer 10 and 11 and Voyager 1 and 2, from the *Pale Blue Dot* to SNL

Abstract

 Pioneer 10 and 11, and Voyager 1 and 2 have the distinction of being the only human-made objects to have left or be on track to leave the Solar System (other than the recently launched New Horizons mission). While their scientific work is significant, a deeper study of the legacy of these probes reveals their impact on the cultural history of spaceflight. Through an examination of the cultural legacies of the probes, centred on work of science communicator Carl Sagan, we reveal that, beyond their scientific achievements, the Pioneer and Voyager probes left deep impacts on our collective understanding and imaginings of spaceflight and space exploration (i.e. “astroculture”). We find that the twin Pioneers and Voyagers inspired self-reflexive ideas of human isolation and fragility within the cosmos, introduced communication with extraterrestrials as a serious aspect of spaceflight efforts, and supplemented the image of the astronaut with the robotic probe as the symbol of the human spirit of exploration. Through this study, we situate the Pioneer and Voyager probes among the most culturally impactful space missions in human history.

Introduction

 On August 25, 2012, Voyager 1 crossed the heliopause to great fanfare from the media and the general public, becoming the first human-made object to enter interstellar space. Its twin, Voyager 2, would attract similar attention by doing the same on November 5, 2018 (“Planetary Voyage,” n.d.). The considerable attention attracted by the twin Voyager Probes, nearly four decades after their launch speaks to the unique nature of Voyager and their predecessors, Pioneer 10 and 11. Other than New Horizons, these four probes are the only human-made objects that have left or are on track to leave the Solar System. Thus, while the Pioneer and Voyager contributed greatly to space science and our understanding of the outer Solar System, it is the interstellar aspect of their missions that is unique in the history of space exploration and space science.[[1]](#footnote-1) Unlike other robotic probes that have explored the Solar System, Pioneer and Voyager possess the trailblazing element of being the first human-made objects to travel towards interstellar space. Physicist Gregory Matloff (2005) characterizes the probes as “four tiny emissaries of humanity [that] have left the realm of the planets and will drift between the stars for near-eternities of times” (xxvii).

The unique legacies of these four probes is reflected in our collective imaginings of spaceflight or “astroculture.” Alexander Geppert (2012) coined the term “astroculture”, defining it as the “heterogenous array of images and artifacts, media and practices that all aim to ascribe meaning to outer space while stirring both the individual and the collective imagination” (220). Beyond their scientific and technical impacts, the most famous space missions in human history – from Sputnik 1 to Apollo – have led indelible marks on how we collectively and individually understand the significance of outer space and how we ascribe meaning spaceflight (220-21).

Thus, we set out to define the place of the Pioneer and Voyager probes among those missions that have fundamentally shaped our contemporary astroculture. Where can we situate the four probes among the company of Neil Armstrong or Yuri Gagarin? In this analysis, I will argue that the unique trailblazing nature of the Pioneer and Voyager probes and – more importantly – the framing of these probes within our cultural memory have had profound impacts on astroculture, equal to some of the most famous space missions in human history.

We will breakdown the probes’ influence on astroculture along three distinct axes of analysis. Firstly, preeminent science promoter Carl Sagan is at the centre of the probes’ cultural legacy. Sagan’s framing of the significance and meaning of Pioneer and Voyager is key to exploring the unique cultural legacy of the missions. While, as products of the “post-Apollo” era, Pioneer and Voyager failed to inspire the same mass enthusiasm as Apollo, Sagan’s framing of the missions ensured they influenced astroculture in subtler ways; Sagan’s *Pale Blue Dot,* taken by Voyager 1,inspired self-reflexive ideas of human cosmic isolation and fragility, which creates an impetus for transnational human unity and the preservation of our planet. The probes’ roles as the first interstellar messengers, through the Pioneer Plaque and Voyager Golden Record, introduced communication with extraterrestrial intelligence as a serious aspect of human spaceflight efforts. Finally, the trailblazing nature of the probes and the frequent use of the metaphor of the explorer when describing Pioneer and Voyager helped supplement the figure of the astronaut with the robotic probe as the embodiment of the human spirit of exploration.

Historical and Scientific Context

The Missions Themselves

 While the focus of this analysis is on the cultural legacy of Pioneer and Voyager, the probes were, at their heart, scientific missions. It is the framing of their scientific work by cultural actors and forces that has driven the probes’ impact on astroculture. Thus, it is worthwhile to briefly overview the missions themselves before beginning our analysis.

Pioneer 10 and 11

 After the success of the hardy Pioneers 6 through 9, NASA launched the Pioneer Jupiter Project, in pursuit of the goal to be “the nation that first flies to Jupiter and beyond” (Wolverton 2004, 48, 50–53). The Pioneer Jupiter Project would launch two near-identical probes towards the outer planets: Pioneer 10 and 11 (50-51). Pioneer 10 would launch on March 2, 1972; just over a year later, Pioneer 11 would lift off, on April 6, 1973 (Siddiqi 2018, 94, 102).

 Pioneer 10 accomplished many firsts, including being the first spacecraft to fly past Mars and to visit Jupiter (Siddiqi 2018, 94). After its encounter with Jupiter in 1973, Pioneer 10 headed out of the Solar System in the direction of the star Aldebaran in the constellation Taurus (97). This course has taken the probe in a very different direction than the other three probes, “toward the nose of the heliosphere in an upstream direction relative to the inflowing interstellar gas” (97). Pioneer 10 would study the outer Solar system until routine contact with the probe was ended in 1997; the last transmission from Pioneer 10 was received by NASA’s Deep Space Network in 2003 (Siddiqi 2018, 97; “The Pioneer Missions” 2007).

 Pioneer 11 would fly past Jupiter a year later in December 1974 (Siddiqi 2018, 102). It would then approach Saturn in September 1979, as the first spacecraft to visit the sixth planet (102). Interestingly, Pioneer 11 would cross the orbit of Neptune after its successors, Voyager 1 and 2 (102). Pioneer 11 is headed in the opposite direction as its twin, towards the constellation Sagittarius (102). Pioneer 11 continued to study the solar wind and cosmic rays until the termination of routine contact on September 30, 1995, and NASA has not received a transmission since November 24, 1995 (Siddiqi 2018, 102; “The Pioneer Missions” 2007).

 Most interesting for our analysis are the probes’ status as the first human-made interstellar spacecraft. As the first probes to venture beyond Mars towards the outer planets and towards interstellar space, Pioneer 10 and 11 have set the tone for future deep-space missions (Wolverton 2004, 4). Science-fiction writer Eric Burgess would notice this as well, noting that “Pioneer 10 would be humanity’s first ambassador to the universe” (75). Burgess, thinking “…it would be a shame to send it out without some kind of message to extraterrestrials,” was one of the catalysts for the first interstellar message – the Pioneer Plaque (75-76). The introduction of interstellar communication to our conception of spaceflight and space exploration would be one of the most important cultural legacies of Pioneer 10 and 11, as we will explore in this paper.

Voyager 1 and 2

 The idea for Voyager 1 and 2 began in 1965, with the stunning discovery that a once-in-every-176 years alignment of the planets in the early 1980s would allow a single spacecraft, launched in the late 1970s, to visit the outer planets one after another in rapid succession (Pyne 2010, 20). This opportunity would inspire a project known as the “Grand Tour,” an ambitious plan to visit each of the outer planets; the Grand Tour was envisioned as “a noble complement to Apollo” (20-21). The original vision for a Grand Tour would fall victim to a lack of funding and NASA infighting (24-25). Eventually, a mission dubbed the “Mariner Jupiter/Saturn 1977 Planetary Exploration (Outer Planet Missions)” was approved, calling for two spacecraft that would explore the outer planets, in the spirit of the original Grand Tour and to take advantage of the planetary alignment (30). Five months before launch, “MJS 77” would be rechristened as “Voyager” (31). Voyager 2 launched on August 20, 1977; sixteen days later, on September 5, Voyager 1 followed its twin into space (Williams 2020).

 Although it was launched later, Voyager 1’s faster trajectory meant it would overtake Voyager 2 en route to Jupiter and Saturn (Siddiqi 2018, 143). Beginning in April 1978, Voyager 1 would encounter Jupiter, studying the planet and the Jovian moons, including discovering the moons Thebe and Metis (143). In November 1979, Voyager 1 arrived at Saturn (144). It would closely study Saturn’s rings, discover five new moons, and flyby the moon Titan (144).

Voyager 2 represents, to date, the only human expedition to Uranus and Neptune (Siddiqi 2018, 140–41). The mission’s primary goals, however, were encounters with Jupiter and Saturn (140). Voyager 2 would first encounter Jupiter in April 1978, making close passes with the Jovian moons (138). It would then head towards Saturn, on a specific trajectory that would allow Voyager 2 to be sent towards Uranus and Neptune afterwards (139). After studying Saturn through 1971, the decision was made to send Voyager 2 towards the last two planets of the Solar System (140). After a four-year journey from Saturn, Voyager 2 began observing Uranus on November 4, 1985, beginning its near-encounter with the planet on January 22, 1986 (Pyne 2010, 244–45; Siddiqi 2018, 141). Three years later, Voyager 2 finally encountered Neptune, flying by the last planet in August 1989 (Pyne 2010, 288).

After their studies of the outer planets, the two probes would fly out of the Solar System on two very different trajectories. Voyager 1 is moving high above the ecliptic plane out of the heliosphere, while Voyager 2 is arcing “downwards” below the ecliptic plane (Burgess 1988, 175–76). After their planetary encounters, the probes’ mission would be redesignated as the Voyager Interstellar Mission (Siddiqi 2018, 120, 122). Both Voyagers continue to return scientific data on the environment of the outer solar system and the edge of the heliosphere (Burgess 1988, 175; “Interstellar Mission,” n.d.). At the time of writing, NASA continues to communicate with both Voyagers and will continue to do so until their power sources run out (“Planetary Voyage,” n.d.).

The framing of the science conducted by the Voyager probes would form an important part of the probes’ cultural legacies, but no aspect of their mission had a greater impact that the *Pale Blue Dot.* As Voyager 1 cruised out of the Solar System after its encounter with Saturn, Carl Sagan convinced NASA to activate its cameras one last time. Throughout February 13 and 14 1990, Voyager 1 turned its cameras back towards the planets to take the famous “Voyager Family Portrait,” capturing the Solar System in 60 frames, from a distance of six billion kilometres from the Earth (Pyne 2010, 312–14). Three of these frames captured the Earth, coincidentally, in the centre of a light ray (“Catalog Page for PIA00452” 1996). These three frames would be combined, picturing the Earth as 0.12 pixel in size in the middle of a ray of light, in an image that Carl Sagan would later dub the *Pale Blue Dot* (“Catalog Page for PIA00452” 1996; Pyne 2010, 314; Sagan 1994, 6–7)*.* We will return to the *Pale Blue Dot* later in our analysis, when we study Sagan’s use of *Pale Blue Dot* to inspire self-reflexive ideas of human cosmic isolation and the fragility of Earth.

The post-Apollo era and the “Golden Age of Planetary Exploration”

 When thinking about the cultural legacy of the twin Pioneer and Voyager probes, we must recognize the wider historical context in which these probes’ missions took place. The creation, launch, and decades-long missions of these probes fall into two important periods of space history: the “post-Apollo” era (from the 1970s until the present day) and the “Golden Age of Space Exploration.”

 With the conclusion of Apollo 17 in 1972, American human spaceflight entered a period of dormancy that lasted nearly a decade; with the brief exception of the Apollo-Soyuz Test Project in 1975, no American would venture into space between the final Apollo mission in 1972 and STS-1 in 1981 (Geppert 2018, 12; Williams 2020). This decade-long interregnum in American human spaceflight after the conclusion of Apollo and the subsequent confinement of humans to low Earth orbit created what is often called the “post-Apollo period” (Geppert 2018, 3). Alexander Geppert (2018) characterizes the post-Apollo period within the context of the crisis-laden 1970s, where the success of robotic spacecraft (including Pioneer and Voyager) would be overshadowed by the memory of Apollo, the political and societal relevance of spaceflight began to fade, and our imaginings of space exploration became “shrunk, bounded, and grounded” (2-4). One important feature of the post-Apollo era, according to Geppert, are the consequences of Apollo’s self-reflexive gaze. For Apollo, “the only newly discovered frontier was, indeed, planet Earth itself (9)”. As we will see, this self-reflexivity will be a key part of the legacy of Voyager as well, in the form of the *Pale Blue Dot.*

 It is within this context that NASA launched the twin Pioneer and Voyager missions towards the outer planets. With the exception of Pioneer 10 (which launched a month before Apollo 17, on March 2, 1972), these probes were launched between the end of the Apollo Program and the first flight of the space shuttle (Williams 2020). Thus, the four probes have spent their entire mission lifetimes within a post-Apollo world, where “limits” have emerged on our imagining of space exploration and the memory of Apollo loomed large (Geppert 2018).

 But, as David Kirby (2018) notes later in the volume, space exploration continued to hold immense relevance in our collective imaginations in the 1970s and beyond (306). With the ideals of the 1950s and 60s behind them, new collective notions of human spaceflight emerged in the post-Apollo context (311-12). What was the role of Pioneer and Voyager in producing new ideas about space and spaceflight in the post-Apollo era, as they hurtled through the outer Solar System and towards their unique missions within the interstellar void?

 One can also contextualize the Pioneer and Voyager probes as part of a period known as the “Golden Age of Planetary Exploration.” This term refers to a frenetic two-decade period, usually defined as spanning from the early 1960s until the late 1970s or early 1980s, in which a considerable number of robotic exploration missions were launched towards the other planets of the Solar System (Neufeld 2018, 83; Pyne 2010, xiv; Shipman 1988, 166). This idea of a “Golden Age” is frequently used when describing Pioneer and Voyager (see Pyne 2010, xiv; Shipman 1988, 172). The framing of Pioneer and Voyager within a “Golden Age” by the literature is important to understanding their cultural legacy. The term is closely associated with the historical Age of Discovery and the metaphor of the historical explorer is prevalent when describing the probes. We will see that the cultural legacy of Pioneer and Voyager is not limited to their work exploring the outer planets, but as a part of this “Golden Age.”

 The context in which the Pioneer and Voyager probes were built, launched, and underwent their missions is vital when considering their cultural legacy. There is a clear break from the ideals and excitement of the 1950s and 60s during the post-Apollo period. How do Pioneer and Voyager contribute to the new set of ideas emerging about spaceflight post-Apollo, and how do they resemble Geppert’s (2018) characterization of the post-Apollo era? The situation of Pioneer and Voyager as a part of a “Golden Age of Planetary Exploration” reveals an important metaphor used to describe and contextualize these missions. The frequent comparison between historical explorers and robotic probes, we will see, is an important part of our conception of Pioneer and Voyager.

Why Sagan?

 In considering Pioneer and Voyager, we will focus on one figure central to our collective cultural memory of these missions – Carl Sagan. What does the work of one figure, no matter how influential, tell us about the greater cultural legacy of Pioneer and Voyager?

 Sagan, as a planetary scientist, was a trailblazer in the “Golden Age of Planetary Exploration.” Astronomer Harry Shipman (1988) remarked, with only partial irony, that “when Carl Sagan got his Ph.D. degree in 1960, the number of American planetary scientists doubled (increasing from one to two)” (165). Sagan was certainly a leading figure in many of the aspects of the Pioneer and Voyager mission most important to their cultural legacy. It was Sagan, along with Frank Drake, who would be approached by Eric Burgess to attach a “postcard” to Pioneer 10 and 11 that would become the famous Pioneer Plaque (Poundstone 1999, 133; Wolverton 2004, 75–76). Sagan would also be the leading figure behind the Voyager Golden Record (Poundstone 1999, 232; Pyne 2010, 348). As we just noted, Sagan would also be the primary advocate for the “Voyager Family Portrait.”

 However, it is Sagan’s status as the face of planetary exploration that makes him so vital to understanding the cultural legacy of Pioneer and Voyager. While numerous scientists and engineers worked and managed the Pioneer and Voyager, it was Sagan that gave these missions their “voice,” as Stephen Pyne (2010) argues (341). Pyne (2010) notes that Sagan “had proposed, explained, boosted, and preserved in print, on TV, and even in gold-plated records the reasons and necessity for humanity’s exploration of space”; for Voyager in particular, Sagan’s task was to “speak publicly to its meaning” (341). *Cosmos,* Sagan’s best-selling book and hit TV series, would cement his legacy as the public face of space exploration and ensure Sagan was the most famous scientist of his time (Poundstone 1999, 262). *Cosmos* became public television’s highest-rated series ever, and it would be seen by half a billion people worldwide (261). The accompanying book was the best-selling English-language science book ever published at the time (262). The series would be popular enough to inspire a 2014 revival led presented by Neil deGrasse Tyson. Given the outsized influence he possessed and his close ties with both missions, Sagan’s perspective has become, in many ways, the most common framing of the meaning and legacy of Pioneer and Voyager. We will discover the “meaning” of Pioneer and Voyager through Sagan because it was often Sagan who defined the “meaning” in the first place.

Analyzing the cultural legacy of Pioneer and Voyager

With the historical and scientific context in mind, let us begin, then, in breaking down the cultural history of the Pioneer and Voyager probes. We will begin by returning to one of the most famous cultural legacies of the Voyager probes – the *Pale Blue Dot.*

“Pale Blue Dot,” cosmic fragility and isolation

 As we noted earlier, Sagan was one of the primary architects of the “Voyager Family Portrait” and its most famous photos, *Pale Blue Dot.* The photos served no scientific purpose, causing many at NASA to be mystified at Sagan’s proposition of a “family portrait” of the planets (Poundstone 1999, 343–44; Pyne 2010, 331). Sagan had an explicit self-reflexive purpose for these photos, however, believing that the Voyager Family Portrait “might help in the continuing process of revealing to ourselves our true circumstances and condition” (344). We will see that Sagan’s analysis of the significance of *Pale Blue Dot* forms one of the most important cultural legacies of the Voyager probe, introducing ideas of cosmic fragility and isolation into astroculture.

Geppert (2018) argues that, for all the ground-breaking work done by the Apollo program, the two photos ‘Earthrise’ (1968) and ‘Blue Marble’ (1972) are, inadvertently, its greatest legacy (9). Given the iconic nature of both photos, these two images certainly had an immense cultural resonance. Geppert argues that, by returning the first-ever self-portraits of Earth from an extraterrestrial perspective, the Apollo program “…made it possible to turn the gaze around, to look back and inward rather than forward and outward…” (9). As Geppert notes, many consider the self-reflexive nature of the photos, “allow[ing] for a complete reversal of viewing directions only possible from an extraterrestrial standpoint,” as a key driver of the “post-Apollo” era (9-10).

 Yet, in 1977, when Voyager 1 returned the first image of the Earth and the Moon in the same frame, the photo attracted little attention from the public (Geppert 2018, 10). Geppert blames the lack of an “implicit ‘human touch’,” for the image’s failure to resonate like ‘Earthrise’ and ‘Blue Marble’ (10). Thirteen years later, however, Voyager would take another “selfie” of the Earth – the aforementioned *Pale Blue Dot,* part of the “Voyager Family Portrait.” It is here our analysis finds the first cultural legacy of the probes. *Pale Blue Dot* would find a cultural resonance comparable to that of ‘Earthrise’ and ‘Blue Marble’, despite its robotic lensman; the success of the photo would stem primarily from its champion, Carl Sagan.

 As the “voice” of Voyager, Sagan would assign meaning to the grainy, 0.12-pixel image of the Earth he called *Pale Blue Dot.* Sagan (1994) would lay out his thoughts on the image in the eponymously titled book *Pale Blue Dot: A Vision of the Human Future in Space,* where he describes his view on the significance of the photo:

Look again at that dot. That's here. That's home. That's us. On it, everyone you love, everyone you know, everyone you ever heard of, every human being who ever was, lived out their lives… Our posturings, our imagined self-importance, the delusion that we have some privileged position in the Universe, are challenged by this point of pale light. Our planet is a lonely speck in the great enveloping cosmic dark. In our obscurity, in all this vastness, there is no hint that help will come from elsewhere to save us from ourselves. (6-7)

This famous pronouncement about the *Pale Blue Dot* would become one of the most enduring cultural legacies of Voyager, with astronomers, journalists, and other figures frequently invoked the memory of the photo and Sagan’s speech (see Koren (2020) for one example). The self-reflexive nature of Sagan’s speech is very much in line with broader shift in astroculture that chacateerize the post-Apollo era. ‘Earthrise’ and ‘Blue Marble’ was a “rediscovery of *inner* space,” according to Geppert (2018, 10); similarly, I argue that Sagan’s framing of the *Pale Blue Dot* are inward-looking and focused on his conception of Earth’s place in the universe.

Geppert (2018) argues that the Golden Age of planetary exploration “contributed to the widespread recognition of humankind’s cosmic isolation…” (13). This idea of cosmic isolation and fragility is certainly present throughout Sagan’s narration of the *Pale Blue Dot. “*The Earth is a very small stage in the vast cosmic arena… Our planet is a lonely speck in the great enveloping cosmic dark,” argues Sagan (1994, 6–7). The implications of Earth’s cosmic isolation and fragility are many, on the part of Sagan. Sagan invokes the same spirit of “ ‘oneness’ among men” that the Apollo mission had created (Geppert 2018, 11). Sagan (1994) believes the image of the *Pale Blue Dot* “…underscores our responsibility to deal more kindly with on another…” (7). In this spirit of “oneness,” Sagan argues against nationalism and war, asking us to “[t]hink of the rivers of blood spilled by all those generals and emperors, so that, in glory and triumph, they could be the momentary masters of a fraction of a dot” (6). Sagan’s transnational argument against war and borders can be seen as part of Sagan’s larger activism against war and nuclear weapons in particular (Poundstone 1999, 314–15). By citing the sense of cosmic fragility shown by *Pale Blue Dot,* Sagan (1994) would have one of his most compelling arguments against the “cruelties visited by the inhabitants of one corner of this pixel on the scarcely distinguishable inhabitants of some other corner…” (6-7).

 The tenuousness of human life is another key argument Sagan (1994) derives from *Pale Blue Dot,* noting that “[t]here is nowhere else, at least in the near future, to which our species could migrate… [*Pale Blue Dot]* underscores our responsibility… to preserve and cherish the pale blue dot, the only home we’ve ever known” (7). The environmental implications of this framing are obvious; cosmic fragility and human isolation create an obvious impetus to preserve our planet. The resonance of Sagan’s connection between *Pale Blue Dot* and conservation is obvious; for example, figures like David Suzuki (2014) have invoked Sagan’s words in their activism against climate change. Suzuki named his final tour of Canada the “Blue Dot Tour,” after Sagan’s famous pronouncement (Suzuki and Hanington 2014).

 By insisting that Voyager 1 take a “family portrait” before it left the Solar System, Sagan created a legacy for Voyager beyond its scientific work on the outer planets. Moreover, his framing of the photo would become one of the most enduring cultural legacies of Voyager. For Sagan, *Pale Blue Dot* demonstrates the cosmic isolation and frailty of human existence; in writing about this isolation and frailty, Sagan would create a lasting call for human “oneness” and the preservation of our planet.

The Pioneer Plaque and Voyager Golden Record

“It may be just four simple words, but it is the first positive proof that other intelligent beings inhabit the universe… ‘Send more Chuck Berry!’ ” claimed the psychic Cocuwa, played by Steve Martin, during an April 1978 SNL sketch. The Chuck Berry song that SNL’s aliens loved so much was “Johnny B. Goode,” part of eclectic eighty-seven and a half minute collection of music that was a part of the Voyager Golden Record, attached to both Voyager 1 and 2 (Ferris 1978, 162, 180).

While the Pioneer Plaque and the Voyager Golden Record had an intended audience out in the stars, I argue that their most salient legacy thus far remains on Earth. They are unique in being among the first serious attempts at interstellar communication; by doing so, Pioneer and Voyager were key in the idea of communicating with extraterrestrials into our astroculture as a serious aspect of spaceflight and space exploration. As we noted earlier, Sagan was a central figure in both the Plaque and the Golden Record; once again, Sagan is closely tied with an important cultural legacy of the Pioneer and Voyager missions.

In 1971, as NASA prepared Pioneer 10 for launch, science-fiction writer Eric Burgess realized that the spacecraft would be the first human-made object to be launched out of the Solar System (Wolverton 2004, 75). Thinking that “… it would be a shame to send it out without some kind of a message to extraterrestrials,” Burgess approached Carl Sagan and Frank Drake about attaching a “postcard” to the probe (74-75). Sagan’s wife Linda Sagan would draw the plaque’s famous (and controversial) naked figures (76). Sagan and Drake devised a map of Earth’s galactic location using pulsars, using the hyperfine transition of the neutral hydrogen atom as the “key” to unlock the plaque’s full message (77-78). Importantly, while the Pioneer Plaque began as a project incidental to the probes’ main mission, “a whimsical extravagance permitted to a couple of fairly influential scientists” (i.e. Sagan and Drake), the plaque quickly became the most famous aspect of the mission (82). Some of this attention was due to controversy over Linda Sagan’s nude human figures; some claimed it was “pornographic,” others felt the drawing excluded certain racial groups, and a handful of feminist figures felt the woman was drawn in too submissive of a stance as compared to the man (79-82). More importantly, many recognized the significance of an artifact dedicated to communicating with extraterrestrial beings. The *New York Times* argued that “[t]he marker launched into space is at the same time a gauntlet thrown down to earth: that the gold-plated plaque convey in its time the message that man is still here – not that he had been there” (quoted in Wolverton 2004, 79).

Five years later, Sagan would be called upon again to create an interstellar message for the Voyager probes. This time, he assembled a committee that included his fellow scientists, as well as soliciting the advice of science-fiction writers (Pyne 2010, 348). Having learned from the experience of Pioneer, the Voyager Golden Record contained a diversity of sounds, music, and photographs from Earth – including the aforementioned “Johnny B. Goode.” As evidenced by the SNL skit, the idea of communicating with aliens, especially with music, resonated with people; Sagan (1978b) noted that the Voyager record project attracted particular attention from the public (38). Forty years later, the track to the Voyager Golden Record would be released on vinyl and win a Grammy (“Press” 2020).

Despite the bevy of scientific measurements and photographs of the outer planets returned by Pioneer and Voyager, examples such as SNL make clear that their role as interstellar messengers resonated among the public. Moreover, the likelihood of either probe being found by an extraterrestrial civilization in the near future is quite low (Matloff 2005, 178). Rather, as William Macauley (2018) notes, the significance of the Plaque and the Golden Record is that they have been “reinterpreted and deployed within a diverse range of narratives, media, networks and social groups to draw attention to… the reciprocity of human agency and cultures of the imagination ” (315-16). The remixing and deployment of the Plaque and Golden Record in contexts beyond the immediate context of Pioneer and Voyager is a testament to their greater cultural legacy. One example is the album *Scrambles of Earth,* a remix of the Voyager Golden Record “created” by aliens (Helmreich 2014). Stefan Helmreich (2014) argues that the remix “press[es] us to consider what extraterrestrial habits of hearing or listening might be like…” (7). This is just one example of how the idea of communicating with extraterrestrial civilizations is far more culturally significant than the off chance of actually doing so through Pioneer or Voyager. As Sagan (1978a) himself argues, the significance of the Pioneer Plaque and Voyager Golden Record is that it proves “no one sends such a message on such a journey, to other worlds and beings, without a positive passion for the future” (236).

The importance of Plaque and Golden Record to our cultural memory of the missions can also be seen in the example of New Horizons. As the first spacecraft launched out of the Solar System since the twin Voyagers, many sought to attach a message similar to the Plaque or Golden Record to New Horizons. A failed effort by Sagan collaborator Jon Lomberg, titled the One Earth Message, sought to attach a similar message to the probe. When his efforts failed, Lomberg bemoaned that “New Horizons will… wander forever among the stars without a message for anyone” (Lomberg 2018). The immediate impulse by many to attach a Pioneer or Voyager-like message to New Horizons and the disappointment at NASA’s refusal is clear evidence of the immense cultural legacy of the Plaque and Golden Record.

Matloff (2005) notes that the longest-lived human artifacts will be interstellar probes like Pioneer and Voyager; in the void of space, the probes will last billions of years (177). Perhaps at some point, these messages will be found by an extraterrestrial civilization. However, our analysis has shown that the greatest impact of these interstellar messages, for now, has been on Earth. The Pioneer Plaque and Voyager Golden Record introduced the idea of communication with extraterrestrial civilization as a serious, scientific enterprise. Through this, extraterrestrial communication\ Their symbolic value is far greater than their communicative value, as the Plaque and Golden Record have become one of the primary parts of our cultural memory of the Pioneer and Voyager missions.

Robotic explorers of the frontier

 Space exploration has commonly been associated with images of historical explorers of the frontier. The historical explorer is held up as evidence of an innate human spirit of exploration, that justifies the costs and difficulties of spaceflight. For example, John F. Kennedy, in his famous 1962 Rice Stadium Moon speech, evoked the example of British explorer George Mallory and his motivation to climb Mount Everest simply because “it was there”. Just like Mallory, Kennedy justified Apollo because “space is there, and we're going to climb it, and the moon and the planets are there, and new hopes for knowledge and peace are there…” (“JFK Rice Moon Speech” n.d.). It is the through a study of this metaphor that we find the final aspect of the cultural impact of Pioneer and Voyager: the introduction of unmanned probes into the metaphor of the space explorer.

 The metaphor of the explorer is particularly prevalent in discussions about Pioneer and Voyager, within the context of the “Golden Age of Planetary Exploration.” As we noted earlier, the metaphor of the historical Age of Discovery is frequently used when describing the Golden Age of Planetary Exploration. Within the context of the literature used for this paper, for example, we see Shipman (1988) arguing that, during the Golden Age of Planetary Exploration, “our knowledge of the Solar System… expanded as explosively as our knowledge of the earth did about five hundred years ago, in what is now referred to as the Golden Age of Discovery” (208). Stephen Pyne (2010), in describing the significance of Voyager, argues that the missions are a part of “a Third Great Age of Discovery, the most recent revival of geographic journeying and questing… that, for Western civilization, traces back to the fifteenth century” (xiii). Throughout the literature, the metaphor of the historical explorer is prevalent when describing Pioneer and Voyager.

 Once again, Sagan is our best evidence of the salience of this metaphor. In his wildly popular book *Cosmos,* Sagan (1980) characterizes Pioneer and Voyager as “voyages of exploration and discovery [that] are the latest in a long series that have characterized and distinguished human history” (112). Notably, Sagan’s framing directly equates robotic probes like Pioneer and Voyager with historical human-led efforts of exploration. He describes the Voyager probes as claims “the lineal descendants of those sailing-ship voyagers of exploration… The Voyagers are caravels bound for the stars…” (121).

 Geppert (2018) argues that the successes of human spaceflight before the 1970s, culminating with Apollo 11, overshadowed the successes of robotic spacecraft in the post-Apollo era (in the 1970s and beyond) (3). The framing of Pioneer and Voyager as part of the tradition of historical human exploration, however, demonstrates the cultural importance of robotic probes and the human-robot “partnership” in outer space. The robotic probe plays just as prominent a role as the astronaut, becoming “extensions of the human senses… across hundreds of million so miles…” (Burgess 1988, x). Pioneer and Voyager are trailblazers in this regard, as their success is frequently tied with the image of a robotic version of the historical explorer. Sagan (1994) argues “the future belongs to robot-human partnerships that will recognize the two *Voyagers* as antecedents and pioneers…” (82). The trailblazing scientific success of Pioneer and Voyager has been contextualized within the metaphor of the explorer; by doing so, the likes of Sagan have transformed our astroculture to include the robot in our image of the space explorer.

Conclusion

 Pioneer and Voyager were certainly valuable sources of data and photographs of the outer planets, as was their primary mission. The greater legacy of these probes, however, is in the ideas they introduced to our post-Apollo “astroculture.” Carl Sagan would play a central role in creating and shaping the cultural meaning derived from the work of Pioneer and Voyager. Through the image *Pale Blue Dot,* Sagan would use Voyager 1 to demonstrates the cosmic fragility and isolation of Earth, creating a call for transnational “oneness” among humans and the need to protect and preserve the fragile Earth. As the first serious attempts at interstellar communication, Pioneer and Voyager would introduce the idea of communicating with extraterrestrials as a serious, scientific enterprise. The idea of the Pioneer Plaque and Voyager Golden Record would have a far greater impact than the physical artifacts themselves, as culturally significant symbols. Finally, as trailblazers in deep-space exploration, Pioneer and Voyager would help supplement the figure of the astronaut with that of the robotic probe, as the central figures for the human spirit of exploration in the cosmos. As robotic probes that have gone where no human has gone before, the image of Pioneer and Voyager have become lasting parts of the metaphor of exploration and discovery in outer space.

Any space mission leaves a tremendous impact; they are scientific and engineering achievements beyond compare in human history. However, there are a handful that have left a deeper historical impact that this – Sputnik 1, Vostok 1, Apollo 11 are among the missions that might come to mind. The impact these missions have had on our collective imaginings of spaceflight – astroculture – are deep and have profoundly influenced the history of spaceflight. Through our three-pronged analysis, we have demonstrated that, while subtler, the impacts of the Pioneer and Voyager probes on astroculture are equally profound and deep.

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1. While “Pioneer” refers to multiple missions, for ease of language, “Pioneer and Voyager” will refer to Pioneer 10 and 11, and Voyager 1 and 2, as a collection of related, interstellar missions. [↑](#footnote-ref-1)