

Malinowski In Orbit

'Magical Thinking' in Human Spaceflight

By Deana L. Weibel and Glen E. Swanson

On 12 April 1961, Yuri Gagarin became the first human being to orbit Earth. Before his historic flight began, as his bus motored him toward the launch pad, Gagarin realized he had a human need. Instructing the driver to pull over near the railroad tracks used to haul the massive rocket into position, Gagarin exited and relieved his bladder against one of the bus's tires. Mission accomplished, he reboarded the bus and went on to complete his task of launching into space and bringing glory to the Soviet Union.

This incident would probably have never become part of the canon of space lore but for one thing: Gagarin's flight was successful, and the cosmonauts who followed him wanted to experience the same degree of success. To this day, cosmonauts flying for what is now the former Soviet Union will stop en route to the launch pad and relieve themselves against their bus's tire. The purposeful care and attention of performing this act prior to each flight (which is carried out by female cosmonauts using a precollected vial of urine) seems to mark it as something beyond mere tradition.

This sort of ritualistic behavior was studied in detail by Bronislaw Malinowski (1884–1942), a Polish-born British scholar who was one of the founders of contemporary sociocultural anthropology. The communities he studied in the 1910s included tribal groups in New Guinea, especially the Trobriand Islands. Malinowski looked at the rituals the Trobriand Islanders used before setting sail on dangerous fishing expeditions and for ensuring the fertility of their gardens, noting how they integrated magic, religion, and science. If Bronislaw Malinowski had been able to study the Soviet cosmonauts, he may well have con-

sidered this bus tire ritual a form of magic, similar to what he had seen among the tribal peoples he studied decades before.

Although it may seem surprising to apply Malinowski's theories, based on his research on groups of horticulturalists and fishermen, to participants in the earliest attempts at human spaceflight, the two groups actually have a lot in common. Malinowski describes the Trobriand fishermen as risking their lives in shark-filled waters and braving stormy seas. The earliest space voyagers explored the uncharted, dangerous territory of space. Members of both groups faced great risks and were placed in situations where they often had little control about the outcome. Both groups turned to magical thinking (often referred to in common language as "superstition") and religion to give themselves a feeling of control in circumstances where they were essentially powerless.

Malinowski believed that magical and religious thinking were not replacements but complements to scientific thinking. He argued that the Trobriand Islanders, assumed by many anthropologists at the time to be mystical primitives whose supernatural frame of mind permitted no logical thought, could be perfectly scientific and rational in the right circumstances. Malinowski stated that the islanders used "knowledge and work" when dealing with what he called "the well-known set of conditions," but turned to magic (and religion) when confronted with what he called "the domain of the unaccountable and adverse influences" (Malinowski, 29).

Malinowski wrote that the ability to rely on both magical and scientific thought was characteristic of humankind as a whole and was based less on categories of "primitive" versus "civilized" than on the circumstances in which people found themselves.



Dr. Bronislaw Malinowski
Credit: London School of Economics Library

Situations where individuals had knowledge and control encouraged scientific thought. More mysterious and unpredictable situations led to magical thought.

Malinowski's explanation for this was psychological. He contended that when confronted with danger or doubt, humans had a strong desire to react in a productive way, even if no productive reaction was possible. In *Magic, Science and Religion*, Malinowski explained the effect in this way: His anxiety, his fears and hopes, induce a tension in his organism which drives him to some sort of activity. Whether he be savage or civilized, whether in possession of magic or entirely ignorant of its existence, passive inaction, the only thing dictated by reason, is the last thing in which he can acquiesce. His nervous system and his whole organism drive him to some substitute activity (Malinowski, 79).

Magical thinking, then, does not occur because of some character defect or some basic flaw in reasoning; instead it occurs when the mind is driven to act but is given no pragmatic outlet for this desire. Malinowski argued that turning to magic and religion in times of anxiety was, in fact, beneficial, as it reduced tension and restored a feeling of control.

For the sake of clarity, we will further define the terms Malinowski used to describe human responses to danger and lack of control, setting these terms within the luck-based world of gambling. Scientific thinking is causal. If a gambler ensures a winning poker hand by hiding an ace up his sleeve, a scientific, albeit morally questionable, goal is met. Magical thinking or superstition, like scientific thinking, is also causal in nature. It is described by anthropologists as the belief that by demonstrating command of one aspect of reality, a person can have an impact on other aspects

of reality, even though there is no physical relationship involved. For instance, a card player may rub his lucky rabbit's foot before his hand is dealt, believing that touching this lucky charm will have an effect on the outcome of the deal. This qualifies as magical thinking because of the perceived link between the ritual action and the desired result.

The main difference between scientific and magical thinking is the proven efficacy of the behavior. It is possible to demonstrate that a person cheating at cards, as long as he doesn't get caught, has a real, measurable advantage over players who don't cheat. A player rubbing a rabbit's foot, however, is neither less likely nor more likely to win a poker hand than a person without a lucky charm of some kind. He only believes that his action gives him an advantage.

Religious thinking is not causal. A gambler may pray that he will be dealt a winning poker hand, but he will probably acknowledge that God (or the gods) can choose whether or not to heed that prayer. Religious thinking does not assume the desired outcome, while both scientific and magical thinking do. Malinowski essentially argues that actions based on both magical and religious thinking, while different in terms of underlying beliefs involving cause and effect, can be used in situations where actions based on scientific thinking are not possible or are not enough to generate a desired outcome.

Both magical and religious thinking can lead to "ritual" behavior. Rituals resemble routines, and routines can have a very positive, nonmagical effect on a person's mood. There is a difference between rituals and routines, however. According to George

Gmelch, who applied Malinowski's ideas to the activities and beliefs of baseball players: Sometimes practical elements in routines produce tangible benefits, such as helping the player concentrate. But what players often do goes beyond mere routine. Their actions become what anthropologists define as ritual—prescribed behaviors in which there is no empirical connection between the means . . . and the desired end . . . Because there is no real connection between the two, rituals are not rational, and sometimes they are actually irrational (Gmelch in Warms et al., 205).

Magical and religious thinking, then, can lead to ritualistic behavior, and Malinowski argues that people engage in these behaviors in stressful situations, situations where their ability to exert control is limited.

If we take Malinowski's theories and apply them to the earliest days of human spaceflight (we will also be considering



Shortly after the successful landing on the surface of the moon, Apollo 11 Lunar Module Pilot Buzz Aldrin took communion. At 105:25:38 Mission Elapsed Time Aldrin radioed Houston: "This is the LM pilot. I'd like to take this opportunity to ask every person listening in, whoever and wherever they may be, to pause for a moment and contemplate the events of the past few hours and to give thanks in his or her own way..." During the radio blackout, Aldrin took out two small plastic packages, one containing bread and the other a small vial of wine and miniature chalice. "I poured the wine into the chalice our church had given me. In the one-sixth gravity of the moon, the wine curled slowly and gracefully up the side of the cup. It was interesting to think that the very first liquid ever poured on the moon, and the first food eaten there, were communion elements." The scene was faithfully depicted in the sixth episode "Mare Tranquillitatis" from the highly acclaimed 12-part HBO series "From the Earth to the Moon." Just before partaking of the sacraments, Aldrin took out a small card and read the words printed "I am the vine, you are the branches. Whoever remains in me, and I in him, will bear fruit; for you can do nothing without me." Aldrin brought back with him the chalice used during the historic Apollo 11 mission and later donated it to the Webster Presbyterian Church in Webster, Texas where it remains on display today. In addition to the chalice, Aldrin also donated to his church a rectangular medallion that he also carried to the moon. The small gold medallion depicts the seal of the United Presbyterian Church in the United States of America.

photos courtesy Judith Haley Allton and the Webster Presbyterian Church.

human spaceflight in contemporary times and the experiences of those involved in ground-based aspects of space exploration), does the predicted pattern emerge? First it is necessary to demonstrate that spaceflight is, in fact, stressful. Fortunately, there's ample evidence for this. Space medicine specialists working for NASA characterize space travel as something that heightens the stress levels of its participants. Raymond P. Stowe, Duane L. Pierson, and Alan D.T. Barrett, in their article "Elevated Stress Hormone Levels Relate to Epstein-Barr Virus Reactivation in Astronauts," describe tests of the levels of Epstein-Barr (EBV) specific antibodies and neuroendocrine hormones in the blood plasma of astronauts. Astronauts were tested during their annual medical exams, ten days before liftoff, the day they landed, and three days after landing. The authors state that the "findings indicate that physical and psychological stresses associated with spaceflight resulted in decreased virus-specific T-cell immunity and reactivation of EBV" (Stowe et al., 893). The stress experienced by the astronauts tested was real and measurable.

In addition, M. Ephimia Morpew; a NASA psychologist whose work focuses on Operational Habitability, Human Factors, and Performance; sheds light on the psychological and emotional stress experienced by astronauts, particularly during long duration spaceflight. Morpew's article "Psychological and Human Factors in Long Duration Spaceflight" identifies a great many stressors experienced by humans in space, including several that involve limitations to astronauts' ability to control their situation, such as "Limited possibility for abort/rescue," "High-risk conditions & potential for loss of life," and "Hostile external environment" (Morpew, 75).

Space travelers themselves have frequently confirmed that their work is inherently dangerous. When asked "What is the most dangerous part of a space mission?" more than one astronaut has deadpanned, "The part between liftoff and landing." *

One of the better stories illustrating the kind of unexpected danger that may befall unfortunate spacefarers comes from the early days of the Soviet human space program and can be found in David Scott and Aleksei Leonov's memoir *Two Sides of the Moon*. In March 1965, history was made when the world's first spacewalk took place. Cosmonaut Aleksei Leonov exited an inflatable airlock (attached to his two-person Voskhod-2 spacecraft) to float around in the openness of space, totally unencum-

bered except for the life-saving umbilical that connected him to his ship. The event was transmitted live to mission controllers on the ground via television. To the uninitiated, the task looked simple enough. Few observers could tell that Leonov was actually struggling for his life.

Shortly after exiting the spacecraft, Leonov's protective suit ballooned in the vacuum of space, making it difficult to move or bend. The simple act of closing his hand was next to impossible due to the increasing pressure building in his suit. After walking into the history books, Leonov tried to return to his spacecraft only to discover that he could not fit through the hatch due to his suit's unexpected inflation. Struggling to get in, Leonov had to resort to a last ditch, desperate attempt at bleeding oxygen from his suit to decrease pressure so that he could reenter the spacecraft. This worked, but then Leonov's real troubles began.

When it came time to fire the retro-rocket to return to Earth, the spacecraft's onboard automatic control system failed to properly orient the spacecraft. After careful deliberations, ground control ordered the cosmonauts to undertake a rarely performed manual orientation. Using the manual orientation system, however, was no easy task. In order to initiate it, both cosmonauts had to unbuckle and leave their seats. The commander, Petr Beliaev, also had to take off his space helmet because he could not bend his neck in it. He then lay down across both seats while Leonov crawled under his seat and held him by his torso to prevent Beliaev from floating in the spacecraft's zero gravity environment. Only when lying down could Beliaev use both hands to operate the manual controls. After the craft was properly oriented, the cosmonauts could finally fire the retrorocket. First, though, they had to return to their seats to balance the spacecraft. When this was accomplished, the men found that they had lost precious time during their emergency maneuver and were now 30-40 seconds late in their timeline.

As a result of these delays, the spacecraft overshot its landing point and they set down in the middle of a deep forest not far from the Chinese border. To add even more stress to what was already a stressful situation, they had to spend two nights in the snow without food or heat, hiding from hungry wolves in their space capsule before a rescue team was able to reach them. We have no report as to whether the men resorted to magical thinking or prayer, but we are

inclined to believe they must have at least been tempted.

The few scholars in the psychological and social sciences who have studied space travel have made it clear that astronauts and cosmonauts are frequently in situations that cause stress. Psychologist Albert A. Harrison, in *Spacefaring: The Human Dimension*, devotes a chapter to stress and coping during space travel. Some sources of stress he notes include "the possibility of not returning alive;" stressors resulting from the physical environment such as G-force, vibration, and temperature extremes; and interpersonal stressors resulting from isolation from family and the inability to remove oneself from the presence of other crewmembers.

Lawrence Palinkas, Jeffrey Johnson, and James Boster explore interpersonal stressors in their article, "Social Support and Mood in Isolated and Confined Environments." They note that both NASA and the Russian Space Agency have learned "to provide psychosocial support to astronauts in flight by facilitating contact with family and friends, sending 'care packages' of cards, music and videos, and offering emotional and other forms of support to families of astronaut personnel during the mission" (Palinkas et al., 16).

Long-term stressors such as those described are often accompanied by short-term stressors resulting from real risk or danger. If Malinowski's theories hold true, we would expect to see evidence of a reliance on magical and religious thinking during times of especial stress, particularly in the early days of the U.S. and Soviet human space programs when less effort was made to provide space travelers with social support as a form of stress reduction. As

Malinowski wrote:

Both magic and religion arise and function in situations of emotional stress: crises of life, lacunae in important pursuits, death and initiation into tribal mysteries, unhappy love and unsatisfied hate. Both magic and religion open up escapes from such situations and such impasses as offer no empirical way out except by ritual and belief into the domain of the supernatural (Malinowski, 87).

Having our expectations firmly in place, let's look at the evidence. What roles did religion and magic play in the experience of early space travelers?

Religion certainly played a role in the U.S. space program. David F. Noble's book *The Religion of Technology: The*

Divinity of Man and the Spirit of Invention, argues that religion and the “useful arts” have been linked together in the predominantly Christian Western world for centuries. Monks, masons, and others felt that the act of creation, aided by scientific thought, was a way to know the mind of God, redeemed the fallen nature of humankind, and “restored dominion over nature” (Noble, 57). Noble notes that technology allowed Christian Europeans to evangelize far and wide, with ships, weapons, and other forms of technology being seen as tools for doing the will of God.

The desire of human beings to go into space, Noble writes, follows in this tradition. He discusses the “religious ethos of the space community” and asserts that, “Bible-study groups proliferated throughout (the Johnson Space Center), in the simulation and training departments, the astronauts’ office, and Mission Control itself” (Noble, 131). In addition to the influence of what Noble describes as a Christian desire to explore the universe in the name of God, it seems likely that the strong religiosity of certain astronauts was asserted almost defiantly as a response to the official atheism of their Soviet rivals.

Examples of astronauts’ religiosity during the Cold War—era abound. The crew of Apollo 8, orbiting the Moon on Christmas Eve, read from the book of Genesis. Buzz Aldrin of Apollo 11, after landing on the surface of the Moon, requested a moment of silence from Mission Control so that he could partake in the ritual bread and wine of his Presbyterian tradition. Communion, there-

fore, was the first food and drink ever consumed on the surface of another world.

One Apollo-era astronaut interviewed in our research described his habit, before liftoff, of asking God to accompany and protect him for the duration of the mission. In addition, other astronauts, such as Jim Irwin of Apollo 15 and Charlie Duke of Apollo 16, had “conversion experiences” after witnessing firsthand the grandeur of space, walking on the Moon and enjoying the awesome view of Earth as seen from both the lunar surface and from orbit.

Conversely, Soviet cosmonaut Gherman Titov, who orbited Earth in August 1961, is renowned for not having had a conversion experience. Although the quotation is sometimes attributed to Gagarin himself, multiple references point to Titov as having said something to the effect that he looked for God while in space and didn’t find him. The atheistic stance of communism seems to have been affirmed by the beloved cosmonauts who stood for the triumph of science over superstition.

That being said, it appears that the cosmonauts, despite the way they were portrayed by the Soviet government, were not above seeking comfort in the realm of the supernatural, and this link between space exploration and the supernatural may have had deep roots. “Russian Cosmism” was a philosophical movement that predated the revolution and was at its strongest in the late nineteenth and early twentieth centuries. Vladimir Lytkin, Ben Finney, and Liudmila Alepko, in their article, “Tsiolkovsky, Russian Cosmism

and Extraterrestrial Intelligence,” write that the movement “deals with the history and philosophy of the origin, evolution and future of the universe and humankind in their genetic unity and mutual influence” and “combined elements from Eastern and Western philosophical traditions, as well as from theosophy, panslavism and Russian Orthodox religious thinking, with the technological optimism of that era” (V. Lytkin et al., 370).

Russian Cosmist Nikolai Fedorovich Fedorov, one of the leading thinkers of the movement, believed that all aspects of the universe contained consciousness and that human beings were required to go into space so that they could help bring order to this chaotic natural consciousness. Fedorov, who believed that scientists of the future would be able to resurrect the dead by gathering and reassembling their dispersed atoms, believed that space travel was required for this to take place.

Another Cosmist, rocket scientist Konstantin Eduardovich Tsiolkovsky, believed that humankind would only achieve happiness through the colonization of space, and famously referred to Earth as a “cradle” that had served its purpose. V. Lytkin et al., state that “Tsiolkovsky’s goal of perfecting humanity in the cosmos places this philosophically inclined rocket pioneer firmly in the Russian Cosmism tradition of technocratic-utopian thinking wherein science and technology are to be harnessed to attain universal happiness” (V. Lytkin et al., 372).

R. Djordjevic, in “Russian Cosmism (With the Selective Bibliography) and its



Traditional Relief - Cosmonauts Viktorenko Alexander, Kaleri Alexander and Flade Klaus (from Germany) are shown participating in the bus stop ritual of urinating on the tire prior to their Soyuz TM 14 flight to the Russian space station Mir which lasted from March 17 - August 10, 1992. Only two photographers were present at this special ritual moment, Only two photographers were present at this special ritual moment, one Russian and the other being Jakob Terweij from The Netherlands who gave us permission to use his photo.

Uprising Effect on the Development of Space Research,” addresses the relationship between Cosmist philosophy and the Soviet space program:

Many of these ideas constituted later in the Soviet period the foundation of great projects, thus initiating the cosmic era of science and technology, marking the triumph of man’s intellect and his doings in general. These projects aroused unprecedented hopes of quick transformation of human life, society, instigating old hopes that some of the problems facing humanity might be solved much quicker with the breakthrough into the cosmic expanses (Djordjevic, 107).

The Russian notion of a spiritual need to enter space and the related belief that space exploration would lead to an idealized future, despite the aggressively atheistic public stance of the U.S.S.R. at the time, may have contributed to the tendency of cosmonauts to occasionally think in non-scientific terms (in addition to the tendency of the Soviet public to idolize the cosmonauts, particularly Gagarin). And if we consider Malinowski’s argument that magical and religious thinking take place in situations where human beings have to confront their own lack of control in a given situation, it seems that the cosmonauts’ need for comfort and reassurance in the face of danger may have been even greater than that of the astronauts, since there is evidence that these Soviet men and women were actually under more stress than their U.S. counterparts.

Historian Slava Gerovitch, in his paper “Trusting the Machine: The Technopolitics of Automation in the Soviet Space Station,” argues that while the earliest U.S. astronauts helped design the machines in which they flew, and therefore understood their workings and were capable of controlling them, the cosmonauts initially had a less participatory role. By design, Soviet spacecraft were characterized by a high degree of automation with the cosmonaut acting as a passenger more than a participant. The cosmonauts served more as monitors and backups to the automated onboard systems, and were effectively taken out of the loop until there was an actual emergency. During flights, cosmonauts were asked not to interfere with the automatic systems. If everything operated normally, the sophisticated machines would handle everything. Cosmonauts really rode their spacecraft rather than flying them.

During Gagarin’s first flight, he flew in automatic mode. Prior to his mission, there was considerable debate among engi-

neers as to whether the cosmonaut should be allowed to even touch the controls. Spacecraft designers took extra precautions against any actions on the part of the cosmonaut during the flight by blocking the manual orientation system for reentry with a digital lock. Prior to his flight, there was disagreement about whether to give Gagarin the combination to the lock, or to transmit it over radio in the event of an emergency. In the end, the story goes that Gagarin was told the combination before his launch, probably increasing his confidence and sense of control.

Rituals like urinating on the bus tire on the way to the launch pad, born during a time when cosmonauts risked their lives in situations that, in most cases, combined great danger with the “passive inaction” expected of them, seem to play a large role in cosmonaut culture. As mentioned before, women cosmonauts were expected to participate in this ritual, as were space travelers from other countries, like Americans working with the Russians on joint missions. From what our research has revealed, this practice continues.

Another ritual that emerged is the viewing of a lengthy Russian science fiction movie produced in 1970 known in English as *The White Sun of the Desert*. This, too, became a tradition and one anecdote discussed the repercussions of missing this film before a mission. It seems a cosmonaut who had already seen the film decided to skip it. The next day his flight was aborted at the halfway point. A Reuters article by journalist Sujata Rao demonstrates both the staying power of the ritual and the risk involved in not carrying it out. Rao writes, “William Shepherd, the U.S. commander of the first crew aboard the International Space Station, said he . . . was unwilling to tempt fate. ‘We watch the movie at 6 p.m. And when we make the stop near the rail tracks tomorrow, I’ll be there too,’ he said.”

While it is often difficult to distinguish between a mundane tradition and an act that has some greater magical purpose, we argue that the two rituals just discussed can properly be described as having characteristics that put them in the category of actions based on magical thinking. Gagarin performed some of these acts and went on to triumph in a situation filled with danger and stress. Post hoc ergo propter hoc. These acts came to be seen as forms of protection against the risks that loomed ahead and have become so essential that everyone who travels as part of the Russian space program is expected to perform them or court disaster.

Malinowski would probably argue that these rituals provide the “safety and comfort of magic.” Cosmonauts are reassured by these acts and their stress is reduced.

Other forms of magical thinking are common among the cosmonauts, even today. Vasily Tsibliyev, who served onboard the space station Mir during its nearly tragic fire in 1997, was in contact with Russian astrologer Tamara Globa several times during his tenure in space. According to author Peter Maass, Tsibliyev credited Globa with correctly predicting the fire and with reassuring him afterward that the worst was over.

Despite our focus thus far on cosmonaut magic and astronaut religion in this article, we are not arguing that cosmonauts never turn to religion or that astronauts never turn to magic. For example, since the fall of the Soviet Union, cosmonauts, formerly exemplars of the communist atheist ideal, have been able to openly resort to religion as a source of comfort. One of our research informants, an American astronaut who served onboard the Mir space station in the late 1990s, told us that his Russian companions kept religious icons in their sleeping cubicles. As years pass and older cosmonauts are joined by those who grew up after the fall of communism, we may see a more explicit emergence of religion as a source of stress relief on Russian spacecraft. Currently, however, cosmonauts seem to retain something of an atheistic stance, at least publicly, and open displays of religion are hard to find.

Finding clear evidence of magical thinking among astronauts is also somewhat difficult. For one thing, the astronauts we’ve contacted have been loath to admit to anything that looks like magical thinking (or superstition), instead describing efforts to create good luck as foolish. Still, magical thinking is almost certainly part of astronaut culture, since this culture has some roots in the superstitious daredevilry of military test pilots and combat pilots who put their lives on the line. For test pilots, danger came from the unproven mettle of the planes they piloted. For combat pilots, danger came from the presence and aggression of the enemy.

James F. Keeshen’s article “Combat Superstitions” discusses the magical beliefs held by Americans who flew Wellington bombers for the Royal Air Force during World War II. Keeshen describes a conversation he and other members of the 12th Bomb Group had with these RAF/Yanks stationed at the Moascar Aerodrome in



Brian Binnie and Mike Melvill are all smiles after Binnie's X-Prize winning flight on October 4, 2004. Note the diamond horseshoe on Binnie's left shoulder, a good luck charm normally worn by Melvill during his riskier flights, but loaned to Binnie on this date.

Photo courtesy William G. Hartenstein

Egypt about how to avoid enemy fire. Practical advice about avoiding German targeting lights soon took a magical turn, demonstrating how little real control these pilots had over their fates in combat situations.

The author learned from the RAF/Yanks that to avoid death, he should never have his photograph taken next to his plane, that he should never let the ground crew wash his plane, that he must wear the same coveralls he wore on his first successful mission on every mission (including the contents in the pockets), and that he should arrange the contents of his footlocker carefully, as though he knew for certain he would be returning soon. These and other beliefs associated with air combat all had the same goal: to ensure the pilot's survival in perilous circumstances. It makes sense that WWII pilots would pass these along to their peers and that similar beliefs would be firmly held by the test pilots that became some of the first astronauts.

While those people flying aircraft and spacecraft experience tension and may turn to magic or religion to relieve it, they also have a straightforward way of lessening anxiety: acting on it. Tension can be reduced by resolving a problem, repairing a broken bit of machinery, or by working out a new change of course. In the world of human spaceflight, astronauts often have a good measure of control, and acting on that control is a source of relief. The ground crew, on the other hand, is often relegated to watching events unfold and we often see magical thinking appear in these circumstances. Often, especially in more recent forays by NASA into space using robotic probes, human agency is limited, because the only humans involved are on the ground

and physically removed from the action at hand. In these cases, the tension becomes palpable.

We see examples of this kind of anxiety and the magical thinking that results from it in M. G. Lord's book, *Astro Turf: The Private Life of Rocket Science*. In it, Lord describes her life as the daughter of a Jet Propulsion Laboratory (JPL) scientist and her efforts to understand the JPL culture as a whole. She often describes this culture in supernatural terms; a launch readiness countdown, for example, is compared to a "responsorial psalm" (Lord, 177). Lord frequently presents situations that demonstrate the efforts of those on the ground to control events through objects, especially items of clothing that hold power. For instance, at one point she describes the JPL crew awaiting the results of the attempted landing of the Martian probe Opportunity in 2004. Its sibling, Spirit, had landed earlier, but was experiencing some temporary mechanical difficulties. Lord writes that the JPL crew's stress about Spirit's operations and Opportunity's effort to touch down led to some interesting results:

Despite the favorable odds, no one was taking success for granted. The scene had a *déjà vu* quality. For superstitious reasons, team members wore the same clothes they wore for Spirit's landing. These were not nondescript items, but true ceremonial vestments, rooted, if perhaps unconsciously, in the clerical culture of Western engineering. Wayne Lee, the chief engineer for entry descent and landing, wore a shirt that was both patriotic and priestly. It had a blue field with white stars on one side and red and white stripes on the other. NASA Administrator Sean O'Keefe wore a totemic polo shirt, the deep rust color of Martian

soil, which bore the mission's logo above his heart (Lord, 206).

As Malinowski would have predicted, the JPL team, forced into a situation where passivity was the only logical response, attempted instead to influence outcomes through magical means.

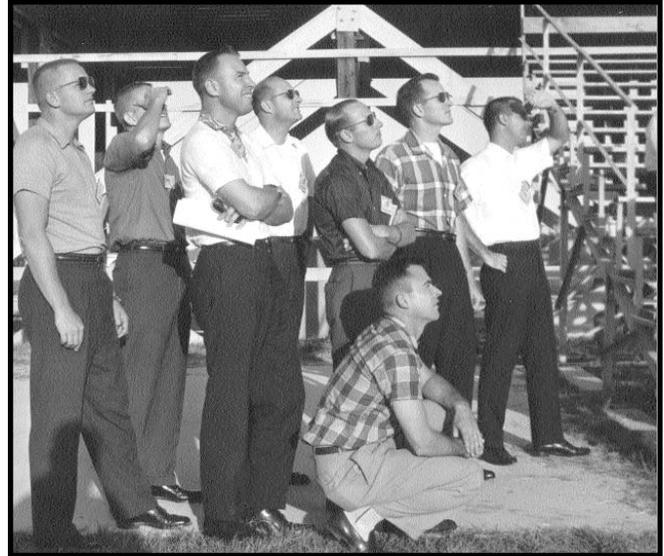
The tendency of those involved in space exploration to use items of clothing as fetish objects is also something Lord describes as having occurred during the days of the Apollo missions. Although Lord uses religious descriptors in this passage, what she is describing, due to its cause-and-effect qualities, seems more magical than religious. She describes the numinous feelings that can result from watching a rocket launch, then ties these to what she perceives as mystical behavior on the part of Gene Kranz, a lead flight director during the Apollo Moon missions:

Worship seems a reasonable response to a giant, achingly beautiful object that hums with mystery and danger. And it harked back to the linkage of Western science to Christian monasticism. Viewed in this context, for example, the weird vestimentary rituals practiced by Apollo mission director Gene Kranz make a sort of sense. For each flight on which he served, Kranz wore a specially made vest—similar to the color-coded chasubles that priests wear for specific feasts (Lord, 172).

What Kranz probably saw as a mere tradition, Malinowski, like Lord, would have interpreted as a protective ritual.

Malinowski noted that magic doesn't always work, and we've seen some real tragedies that have occurred in space despite efforts made in the three realms of magic, religion, and science. The destruction of the Shuttle Columbia in 2003 made the danger posed to astronauts concrete, and caused NASA first to delay subsequent crewed launches for more than two years, and then to slow the pace of Shuttle launches considerably. Even the successful Hubble telescope has suffered as a result of this intensified focus on caution. Because its repair has been reported to be feasible only if humans are physically present to replace worn-out batteries and gyros, and because the mission is considered especially dangerous in light of the Columbia accident, former NASA Administrator Sean O'Keefe declared that a

Fingers Crossed – Eight of the “New Nine”, the second group of astronauts to be selected by NASA, watch with hope and anticipation the launch of Wally Schirra and his Mercury spacecraft Sigma 7 at Cape Canaveral, Florida on October 3, 1962. Shown left to right are Neil Armstrong, Frank Borman, James Lovell, Thomas Stafford, Charles “Pete” Conrad, Edward White II, James McDivitt and John Young. If you look closely, you can see Conrad crossing his fingers (see enlarged photo inset). Armstrong and others may be doing the same. NASA Photo 62-MA8-106. NASA, watch with hope and anticipation the launch of Wally Schirra and his Mercury spacecraft Sigma 7 at Cape Canaveral, Florida on October 3, 1962. Shown left to right are Neil Armstrong, Frank Borman, James Lovell, Thomas Stafford, Charles “Pete” Conrad, Edward White II, James McDivitt and John Young. If you look closely, you can see Conrad crossing his fingers. Armstrong and others may be doing the same. Photo Credit: NASA Photo 62-MA8-106.



Hubble servicing mission would be impossible under the standards imposed by the Columbia Accident Investigation Board. At the time of this writing, the new NASA administrator, Michael Griffin, felt that such a servicing flight is a possibility if all turns out well during the next Shuttle mission.

In an hour-long 19 January 2006 interview with Griffin, conducted by The Orlando Sentinel’s Michael Cabbage, Griffin responded to questions about the risks associated with a Hubble service repair mission, “When we look at the mathematical risk analysis of a Hubble mission versus a station mission, there is essentially no difference. The safe haven of the station protects you against a very small range of things that can happen, primarily something like what happened to Columbia . . . Most of the risk of the shuttle is not associated with what orbit you choose to inject into.”

Despite the current hesitancy of the American space program in the face of danger, space travel has recently made great progress in the private sphere, and this provides us with a new realm in which magical thinking may be located.

In 2004, Burt Rutan’s company, Scaled Composites, won the Ansari X Prize, an award given to the first private company that could launch a three-person capacity vehicle into space, return it safely, and make the round-trip a second time within a two-week period. Scaled Composite’s vehicle, dubbed SpaceShipOne, was taken into space and back by experimental test pilot Michael Melvill on 29 September 2004. Its second flight, which won the prize on 4 October 2004, was piloted by Brian Binnie. The employees of Scaled Composites, which is a much smaller operation than NASA, demonstrate that Malinowski’s predictions work situationally, not just organizationally. In an appearance at the Fountain Street Church in Grand Rapids, Michigan, on 2 February 2005, Michael Melvill described his flight and revealed quite a bit about the role of magical thinking in the lives of civilian astronauts.

Melvill and his wife, Sally, were Burt Rutan’s first employees, becoming a part of Scaled Composites during its earliest days. They were hired as a pilot and a book-keeper, respectively. Before the two were married, when they were still teenagers, Mike commissioned a piece of jewelry, a horseshoe-shaped pin, for Sally. This lucky horseshoe turned out to be as significant, if not more so, for Mike than for Sally. Melvill explained that she insisted he wear this “lucky” horseshoe on all of his dangerous experimental flights and that so far it had worked perfectly.

During his presentation in Grand Rapids, Melvill showed a video clip of his wife pinning the horseshoe onto his uniform. The horseshoe, of course, is a traditional symbol of good luck, and it appears that this pin has become what anthropologist George Gmelch describes as a “fetish.” A fetish is defined as an object (like the special clothing worn by JPL and NASA employees described above) believed (not always consciously) to have magical powers, most often used to attract and maintain good fortune. It is a form of magical thinking linked to an object, not an activity, but still serves to give those with limited control in a dangerous situation a sense of having done or provided something useful and protective. Just as the cosmonauts insist on watching White Star of the Desert and urinating on their bus’s tire before a launch, Melvill is compelled to wear the horseshoe during a dangerous flight.

While it could be argued that Melvill wore the pin out of habit or tradition, or just to please his wife, he revealed something during his presentation that indicated how the pin was truly perceived. Melvill’s first SpaceShipOne journey was successful. Although there were some unexpected rolls and a bit of drama, the craft reached space and returned with Melvill intact. The pin

was with him. We would expect then, based on the theories of Malinowski and their modifications by George Gmelch, that the pin’s protective power would be confirmed by this event. Melvill demonstrated this, noting that Brian Binnie, who made the second flight, was also given the pin to wear. This is apparently a departure from the more common use of the pin as protection for Mike Melvill only. It seems that because the pin was successful for Melvill, and because a second flight had to be made for the prize to be won, those involved determined (probably on a playful, not entirely conscious level) that the protective power of the horseshoe should be extended to Binnie. Fortunately the pin, attached securely to Binnie’s shoulder, “worked” for him also, cementing its status as a protective, magical fetish.

Melvill mentioned another event during his flight that could be classified as involving magical thinking. SpaceShipOne is not launched from the ground; instead an airplane, the White Knight, carries the craft into the upper atmosphere and releases it. SpaceShipOne then ignites its own fuel and travels a shorter distance under its own power out of the atmosphere. Melvill described sitting in SpaceShipOne during the one-hour climb, waiting for his mission to begin. He stated that he was a bit nervous, even bored, but that no one on the ground was willing to talk to him during the ascent. Instead he spent the time in an uncomfortable silence.

This circumstance greatly resembles what Gmelch has identified as a “taboo.” In this type of magical thinking, an action is avoided because it is believed that it may cause disaster. A winning hockey team may refuse to shave during the playoffs, for

DRAWING CHANGE REQUEST

FOR INFORMATION ONLY - NOT TO BE USED FOR FAST INFORMATION

MODEL: VANGUARD D.C.R. NO. DCR-1000

DATE: 18 FEB 1958 PAGE: 1 OF 1

DRAWING APPROVED: 350-70640-48-9

DESCRIPTION OF CHANGE REQUESTED:

DETAIL -31

SAFETY WIRE IN PLACE

GYRO BASE
NO SCALE

* THE COST WILL BE DEFERRED BY FIELD CREW MEMBERS AND NO ADDITIONAL CHARGES WILL BE MADE FOR ENGINEERING, MANUFACTURING, INSTALLATION, INSPECTION, PROCESSING, ETC.

APPROVAL LIST

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STRESS

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MATERIALS

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OPERATIONS

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CONTROLS

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MANUFACTURING

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INSPECTION

CUSTOMER -
[Signature]

T.C.O.
[Signature]
COMPLETE

CHANGE EFFECTIVITY: 005 ONLY (LAST FLIGHT PREP. LOG ITEM)

REASON FOR CHANGE: ADDITION OF DIVINE GUIDANCE

PREPARED BY: F. Paul Lipinski APPROVED: [Signature]

DISTRIBUTION: (1) 1 COPY TO PRODUCTION DESIGN (FOR IMMEDIATE ACTION)
(2) ADDITIONAL COPIES TO INTERESTED GROUPS FOR INFORMATION AND PLANNING ONLY

divine Guidance – Frustrated by repeat failures of the Vanguard launch vehicle, engineers installed a special device to invoke “divine guidance.” On February 18, 1958 after two successive launch failures, engineers submitted formal paperwork requesting a technical modification to the gyroscopic guidance system. The request instructed that a St. Christopher medal be installed to the base of a gyroscope package on Vanguard’s second stage. The “Drawing Change Request” was a standard form required for any design change. St. Christopher is the patron saint of travelers. After two launch failures, the first televised live, officials felt the need to call upon a higher authority to help assure success. Under the form’s heading “Description of change required,” is a drawing of a St. Christopher medal. Beneath the medal is a detailed sketch of the gyro package showing the location of the installed medal. Under the heading “Reason for change” engineers wrote “Addition of Divine Guidance.” Anticipating additional cost for such a modification, those who submitted the paperwork wrote, “The cost will be deferred by field crew members and no additional charges will be made for engineering, manufacturing, installation, inspection, processing, etc.” The form was formally submitted by F. Paul Lipinski, a Catholic engineer who originally suggested the idea and worked for the Martin Company in support of Project Vanguard. Eleven others, among whom were Catholics, Protestants and Jews also approved and signed the design change. The design change request was formally approved February 24 and apparently worked as Vanguard 1 successfully launched March 17, 1958. Photo Credit: Glen Swanson and Deana L. Weibel

example, believing that blades may cut luck and also facial hair. Gmelch describes baseball players who refuse to step on the lines drawn on the field or who refrain from washing certain items of clothing when on a winning streak. The refusal of the Scaled Composites crew to speak to Melvill during his flight as a passenger seems to have much in common with traditions of silence in both baseball and gambling.

In baseball, a “perfect game” for a pitcher is one in which no batter gets a hit for the entire nine innings played. A perfect game, also known as a “no-hitter,” is extremely rare. When it appears that a pitcher may be on his way to achieving this mythical milestone, no one speaks to him. It is also taboo to speak about what may be happening. It is believed by many baseball players and fans that dis-

ussing this rare event will “jinx” it, ruining the pitcher’s chance of success.

In craps, which is a popular game in Las Vegas, among other places, no one may speak to a player having a “hot roll.” As long as the player doesn’t roll a seven (the easiest number to hit), the game may continue and those playing will add chips to their piles. Usually a seven comes up rather quickly. However, if the person rolling the dice seems to be on a hot streak, and a seven hasn’t come up in some time, the table will frequently go silent. If a novice player speaks to (or even comments on the success of) the roller, he will be silenced quickly and with no small amount of annoyance by the other players. Any comment to a person on a streak or acknowledgment of that streak to anyone else can cause it to end.

It appears that the crewmembers who refused to speak to Mike Melvill did so out of a desire to protect the mission and Melvill’s life. When things are going well, magical thinking dictates that nothing disrupt the continuity of good fortune, even the voice of a well-wisher. While this was irritating to Melvill himself, this commitment to silence was probably a source of comfort to those on the ground and provided them with another way to assert some control over the situation.

After his presentation, Melvill was asked by an audience member whether there were other forms of “luck” used in his mission. Melvill looked somewhat embarrassed, but responded in detail:

‘Yeah, lots of people had things for luck. I think Brian’s wife gave him some rabbit’s foot or something, but Sally’s little horseshoe has been with us . . . like I said, we’ve been married 43 years. I gave it to her before we were married, long before we were married. And every time I’ve ever done anything a little bit dangerous, she’ll pin it on me and I find it very comforting to know it’s on there. You know, I don’t know what it really does for you or not, but every pilot that’s in this kind of business does something for luck. Usually they don’t broadcast it though. They do it and keep it private.’ (Melvill, public appearance, 2 February 2005).

Both magic and religion, said Malinowski, serve to reduce tension and anxiety in situations where man is “forsaken by his knowledge.” We would expect to see magic and religion then in rockets, space shuttles, and space stations, and we do. This confirmation of Malinowski’s theories in the area of space exploration is an indication that the field of anthropology may have a lot to offer for understanding the human dimensions of spaceflight.

Unfortunately, little anthropology has been done in this field, for several reasons. For one thing, tight security surrounding the various space programs makes traditional anthropological methods, such as participant-observation, difficult to accomplish. While NASA looks for PhDs in potential astronauts, PhDs in anthropology do not qualify.

In addition, applying anthropological theory to human space travelers strikes many, even within the field of anthropology, as somewhat odd. There is still a prejudice in the discipline in favor of studying so-called “primitive” societies, and no one could describe members of a culture who escape the gravitational bonds of Earth in technologically complex machines “primitive.” Also, the study population, people who have been in space (or who have helped them get there) is extremely small. The benefits of studying such a group would seem to offer little toward the understanding of humankind in its “natural” environment. Space travel seems to be one of the most “unnatural” things that humans have ever experienced.

This being said, no less an authority than anthropologist Margaret Mead called for the anthropological study of this aspect of human culture. A May 1960 speech she gave at the University of

Minnesota's Symposium on the Creative Challenge to Man in the Space Age was later published as a chapter in *Speaking of Space: The Best from Space Digest*. It was titled, "Does It Matter What Women Think of Space?" and in it Mead states:

Nobody is doing decent research in the social sciences in space at all. No one is really considering what the composition will ultimately have to be of groups who will work together in space . . . We are not considering the human aspects either, in our attitude toward space or what space colonization and space travel will ultimately mean. Science-fiction writers are, but science-fiction writers take a very gloomy view of the human race . . . The general picture of humanity being presented through science fiction is very poor. The research on the human element is very poor, and the division in our minds between hardware and technology on the one hand and human lives as they are lived here, is too great (Mead, 224).

Mead was speaking in the early 1960s during a time when the space race seemed like it would have an immediate, enormous impact on everyday American life. She spoke with urgency, believing it necessary to understand both the effects of the space program on typical American citizens and on the active participants in the program. Nearly half a century later that sense of urgency, stoked by the Cold War, has diminished, but Mead's arguments still ring true.

Space travel, whether on the International Space Station, the remaining Space Shuttles or private craft like SpaceShipOne, is a human enterprise and must be understood in human terms. Focusing on the nuts and the bolts without understanding the psychological and cultural mechanisms at work leaves us with an incomplete picture of what is actually occurring. In order for human space travel to be comprehended fully, we must be aware, for example, that humans in space will, like other humans throughout the world, turn to religion and magic as supplements to science. It is only by recognizing the humanity of those involved that we can adequately understand the space travelers of the past and prepare for the space travelers of the future.

* *Unsubstantiated quotes like this have been attributed to different astronauts at different times, and seem to have taken on the character of a legend. John Young is said to have quipped that the most dangerous part*

of his work was "between liftoff and landing," while "between liftoff and splash-down" is sometimes identified as a Gus Grissom quotation.

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