Laika the Canine Cosmonaut: A Dog's Legacy and the Nature of Scientific Inquiry

On November 3, 1957, a small, curly-haired dog hurtled into the atmosphere at an acceleration of almost five times the force of gravity. Alone in a cabin not much bigger than herself, her trip aboard *Sputnik 2* likely wasn't a pleasant one. Nevertheless, the ship successfully entered orbit a few hours after launch. That morning, Laika ("Barker"), as she was called, made history, becoming the first living organism to orbit the Earth. The journey was a culmination of hard work and ingenuity, but also emotional decisions, biases and educated guesses, that nonetheless resulted in significant scientific achievement.

Laika and the dogs which came after her, fondly known as "Soviet space dogs," played an integral role in the Soviet Union's space program, and paved the way for the humans who would eventually follow them into space. The *Sputnik 2* mission followed the similarly historic *Sputnik 1*, which only a month earlier had become the first man-made object to make it into orbit; the first satellite. Four years before Yuri Gagarin, the first person to travel into space, lifted off, and 12 years before Neil Armstrong stepped onto the moon, Laika's mission took place in the still early days of the two-decade long technological and intellectual Cold War battle between the United States and the Soviet Union known as the "Space Race." Around the world, Laika quickly became considered a hero, not only proving that life in space was possible, but dying in the process.

Long before Laika came along, however, Soviet researchers spent years studying how a journey into space would affect a biological system. Enter: Vladimir Yazdovsky, the "patriarch of Russian space biology and medicine."[1] In 1950, Yazdovsky, an ex-army doctor and medical scientist by training, was appointed leader of a Soviet space program devoted to researching biomedical aspects of high-altitude flight. Along with colleagues such as rocket engineer Sergei Korolev, he found and trained various small animals—including dogs, rabbits, mice, and rats—for use in spaceflight tests and simulations. Dogs quickly became apparent to Yazdovsky as the optimal test subjects for flight simulations. They are more physiologically similar to humans than many other animals; for example, dogs and humans share remarkable similarities regarding microbiome flora and digestive function.[2] In addition, their tendency to respond well to commands and training, and their ability to adapt quickly to changing surroundings set them apart from alternative species.[3]

He and his team began collecting stray dogs off the streets of Moscow, as they were thought to be hardy and adaptable. The unspoken understanding was that, unlike pets, no one would miss them if something were to happen. In addition, the researchers preferred female dogs, as they are smaller and generally calmer, and their suits would be easier to design. They

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[1] Medenkov, Alexander A. "Chapter 3: Vladimir Ivanovich Yazdovsky: Biomedical Researcher Supporting Manned Spaceflight." *History of Rocketry and Astronautics: Proceedings of the Forty-Seventh History Symposium of the International Academy of Sciences*, edited by Andrew S Erickson and Rick W Sturdevant, vol. 45, American Astronautical Society, San Diego, California, 2015. AAS History Series

[2] Trevino, Julissa. "A Surprising Way Dogs Are Similar to Humans." *Smithsonian.Com*, Smithsonian Institution, 23 Apr. 2018

[3] Medenkov (n 1)

began running experiments on everything from the dogs' nervous and immune systems, to their physiology, behavior, and reflexes. Contrary to popular belief, Laika was not the first dog in space. In 1951, two dogs named Dezik and Tsygan were launched in ballistic missiles converted for spaceflight, with hermetically sealed cabins. They were in space for about 15 minutes before returning safely to Earth. This experiment verified the possibility of animals surviving space altitudes, at least in the short-term. Over the next few years, dozens more dogs would be sent into space, with various outcomes.

In 1956, one year before the launch of Sputnik 2, the Soviet Ministry of Defense established a division for research and medical support of upper-atmosphere flights, which Yazdovsky would head. One of the new scientists that came aboard to help was Oleg Gazenko, a 38-year old Soviet military officer and World War 2 veteran. In the 1940s, Gazenko attended the Military Medical Academy in Leningrad (now St. Petersburg,) where, in the Aviation Medicine laboratory, he studied physiology and nervous function under high-altitude conditions. One of his research advisors was Academician Colonel-General Leon Orbeli, a previous student of the renowned physiologist Ivan Pavlov, famous for his "salivating dogs," and other behavioral conditioning experiments. Under Orbeli's tutelage, Gazenko learned about Pavlov's theories on behaviorism and his work with dogs, knowledge which served him well in his work with the space dogs. Pavlov had developed a way to surgically modify the dogs he worked with in order to be able to directly observe the inner workings of their various systems in response to his experimental stimuli, such as creating an artificial opening in the stomach that provided access to digestive products. Similarly, Yazdovsky and Gazenko performed surgeries on their dogs so that they could monitor, and subsequently protect, their vital organs. In both cases, the dogs underwent such extensive procedures they were termed "compound technologies"—simultaneously natural and artificial, and subject to their human handlers.[4]

Despite this terminology, the dogs were not seen as objects to be manipulated. Rather, the researchers took them very seriously as human stand-ins. ("No one saw them as 'just dogs,'" Gazenko later remembered.)[5] The space dogs were categorized in groups based on their personalities, such as being quiet and well-balanced, or nervous and excitable. Even the unique names given to each dog reflected their personality or their trainers' feelings about them. The researchers ultimately developed connections with the dogs, and became sentimental in their feelings toward them. Indeed, dogs' established role of 'man's best friend' played a part in the choice to use them in space missions, and publicity surrounding the experiments acknowledged the great service they were providing. Many sources at the time quoted Pavlov saying that "the dog, thanks to its long attraction to humans, and its quick-witted patience and obedience, serves the experimenter with a certain joy … sometimes for its whole life."[6]

This emotional connection between the researcher and participant might now be viewed as having been potentially harmful to the validity of the experimental process or the results

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[4] Nelson, Amy. "What the Dogs Did: Animal Agency in the Soviet Manned Space Flight Programme: BJHS Themes." *Cambridge Core*, Cambridge University Press, 7 Sept. 2017
[5] Ibid.
[6] Ibid.

themselves, due to the inevitable, if subconscious, choices that come when working with material of a personal nature. In addition, it has been argued that all of the studies on the dogs were direct results of the way in which the scientists perceived the dogs.[7] Whereas Pavlov strove to understand the nature of canine physiology regardless of the cost to the dogs, Yazdovsky and Gazenko simply wanted to find dogs that could endure difficult conditions, for which they needed them to be healthy and functioning. However, because the trainers viewed the dogs simultaneously as companions and test subjects, there arose a potential danger in designing experiments with animals which were considered human stand-ins. To tackle this, the team brought in Maria Gerd, an animal trainer who had previously worked in a circus. She understood how to effectively train animals in various contexts, and she ensured that the experiments were designed with the dogs' own physical and mental capacities in mind, and not those of humans.[8]

The difficulties of designing studies with subjects which are so intrinsically associated with people, but at the same time which are so different from humans in many ways, can lead to empirical inconsistencies and biases. Coined by philosopher Michael Strevens, "radical subjectivism" is a model of knowledge acquisition arguing that science is conducted in a non-linear fashion, not strictly following any process or set of rules, but rather is a result of arguments, emotion, and bias—a "microcosm of the multiplicity of human society," as Strevens describes it.[9] Indeed, the Soviet space program scientists were attempting things that had never even been conceived of before, and therefore weren't necessarily following established protocols. There was a lot of experimentation, guessing, and repetition until the dogs produced results that were more or less satisfactory.

In the months leading up to her trip to space, Laika underwent many tests and procedures to determine whether she was fit for flight. Along with two other 'finalist' dogs, Albina ("White") and Muska ("Little Fly,") she was observed for obedience and passivity, exposed to extreme air pressure and loud noises, and ultimately secured in small pressurized cabins for days and weeks at a time, simulating the spacecraft capsule. In the end, the researchers selected her to undergo the mission. Shortly before she was meant to leave, Yazdovsky brought Laika home with him, as he wanted to "do something nice" for her.[10] Two days before the planned launch, Laika was secured in the spacecraft's separate, sealed capsule, wearing her space suit fitted with metal restraints that were attached to the inside of the cabin. The spacecraft itself was about 4 meters high by 2 meters wide, with various GPS transmitting systems, vitals monitoring equipment, and scientific instruments. Additionally, the craft was outfitted with a supply of oxygen, food, and water, as well as a waste disposal system.[11]

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[7] Ibid.
[8] Ibid.
[9] Strevens, Michael. "Chapter 2: Human Frailty." *The Knowledge Machine: How Irrationality Created Modern Science*, Liveright Publishing Corporation, 2020.
[10] George, Alice. "The Sad, Sad Story of Laika, the Space Dog, and Her One-Way Trip into Orbit." *Smithsonian.Com*, Smithsonian Institution, 11 Apr. 2018
[11] "Sputnik 2 - Spacecraft - the NSSDCA." *NASA Space Science Center Coordinated Archive*, National Aeronautics and Space Administration

At 7:30 a.m. local time, Sputnik 2 lifted off from Baikonur Cosmodrome, in what is now Kazakhstan. At the time, the location of the base was a secret, both from the Soviet public and the rest of the world. The Space Race was extremely competitive, and tensions flared between the Soviet Union and the United States. Both nations desperately wanted to be the first to achieve a variety of milestones—including successfully launching the first living being into space. After *Sputnik 1*, the Soviets, now confident in their lead over the United States, marched forward: Only announcing each subsequent success after it happened, they continued to check off milestones, inching closer to winning this Cold War 'battle.'[12] However, as the race became more heated, and the Soviet Union became more desperate to maintain their lead, time became their biggest enemy. As a result, corners were often cut. After Laika took off on that historic November morning, the public waited breathlessly for news of her safe arrival back on Earth. Her safe return was never in the cards—a fact which the research team (and the Soviet government) knew all along. Because of the haste in which the spacecraft, and the mission as a whole, was put together, the research team was never able to develop a method of recovery for the capsule. Essentially, Laika was sent on a one-way mission.

Laika's capsule was stocked with about 7 days' worth of food, water, and oxygen.[13] Despite knowing Laika would not return to Earth alive, the scientists still expected her to last at least a week. In fact, Laika was not meant to be fed before launch due to weight limitations, but—once again highlighting the delicate line between researchers and their subjects—some reports state that a female physician secretly gave Laika one final meal before she left Earth.[14] Documents noting her breathing patterns and heart rates during take-off show that she was still alive when the craft reached orbit, and she successfully circled the Earth in 103 minutes. Unfortunately, though, there was an issue with the spacecraft's temperature regulation; without Earth's atmospheric heat shield, the capsule's internal temperature soon rose to over 100 degrees Fahrenheit.[15] In 1993, over 35 years after the mission, Oleg Gazenko revealed that Laika died soon after launch, likely due to heat exhaustion: "There's really no expectation that she made it beyond an orbit or two after that."[16] Nevertheless, the Soviet Union—attempting to keep up appearances—maintained for a long time that Laika survived for several days after launch, even going so far as to falsify official reports.[17] While Laika's ultimate death was eventually revealed to the public nine days after launch, it wasn't until 2002 that Russian scientists admitted that Laika had actually died just 5-7 hours after launch.[18] The spacecraft itself, however, continued to orbit for five months, before burning up on reentry to the Earth's atmosphere and crashing somewhere in the Caribbean.[19]

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[12] "The Soviet Lunar Program & the Space Race." *PBS*, Public Broadcasting Service
[13] "Sputnik 2 - Spacecraft - the NSSDCA." (n 11)
[14] George (n 7)
[15] "Sputnik 2 - Spacecraft - the NSSDCA." (n 11)
[16] George (n 7)
[17] George (n 7)
[18] Burgess, Colin, and Chris Dubbs. *Animals in Space: From Research Rockets to the Space Shuttle*. Praxis Publishing Ltd, Chichester, UK, 2007.
[19] Wellerstein, Alex. "Remembering Laika, Space Dog and Soviet Hero." *The New Yorker*, The New Yorker, 3 Nov. 2017

The news of Laika's death sparked widespread animal rights protests around the world. Considering the United State's similar use of monkeys and apes in spaceflight tests, it is somewhat ironic that many Americans condemned the Soviet Union's use of animals as subjects of space research. As the years went by, even the very scientists behind *Sputnik 2* expressed much regret. "The more time passes, the more I'm sorry about it," said Gazenko at a 1998 press conference in Moscow. "We shouldn't have done it. We did not learn enough from the mission to justify the death of the dog."[20] A poignant example of how scientific progress can be tainted by political and social motivations, Laika's mission has served as a cautionary tale for subsequent research. Russia's space program continues to this day to use animals in their research, but, more than half a century later, technology (and protocol) has come a long way, and the newest generation of furry test subjects face much better odds than Laika did.

Over the past decades, Laika has pervaded popular culture, becoming a character in films, poems and children's books, and even decorating the faces of matchbooks and stamps. In 1997, a statue depicting heroes of Soviet space exploration was erected at Star City, home to the training center for cosmonauts, with Laika prominently depicted underneath a rocket. Despite having since been heavily criticized, the use of dogs in Soviet space research is an example of the way in which science is often a complex mix of objectivity and emotional involvement. Regardless of current social perceptions surrounding the ethics of using animals in research, it is indisputable that the story of Laika and the people who worked with her is one of scientific advancement, risk-taking, and innovation. While we will never know what was going through Laika's head during her historic journey, she, along with those which came before and after, paved the way for human space travel. Laika cannot meaningfully be said to have chosen to go to space; the extent of her "agency" in the mission was simply her instinctive efforts to survive it.[21] Yet, whatever one may believe about the role of animal agency and emotional connection in scientific research, it is not surprising that the world has remembered Laika for decades as a very good dog.

[20] Ibid.
[21] Nelson (n 4)