

planets and moons, they are now speeding a million miles a day toward interstellar space. Two hundred and ninety thousand years from now, Voyager II will be four light years away from Sagittarius, the brightest star in the night sky.

The purpose of Voyager was to retrieve information for us. But in a brilliant display of forethought, the engineers at the Jet Propulsion Lab also included information *about* us. They asked the popular astronomer, Carl Sagan, to collect the sights and sounds of Earth to be carried with each craft. Sagan recorded these sounds on a disk that he called a “time capsule.” It has since come to be known as the Golden Record.

Sagan’s Golden Record required six months to make. Understandably the choice of what to include presented a formidable challenge. From all of Earth’s images and sounds, what would you have chosen? The disk’s twenty-seven musical tracks included jazz, blues, and folk music. Sagan settled on four composers—Bach, Mozart, Beethoven, and Stravinsky—to represent classical music.

Of all the sounds on the Golden Record, only Beethoven (two tracks) and Bach (three tracks) were given more than one example from a single source. The story is told (although I don’t know if it is true) that the suggestion was made to record *only* Bach, to which Sagan responded that such a thing would be bragging!²

It is true however, and revealing of Bach’s importance to him, that Sagan’s time capsule began with the first movement of the Brandenburg Concerto No. 2. His tenth selection was the Gavotte from the E-Major Partita for solo violin. The seventeenth track was this very fugue.

An Inference of Us

If one takes seriously the idea that this fugue might teach others who we are and what life on planet Earth is like, what might they infer from it?

First they would know that we can hear sounds and that we have the ability to produce complex waves of sound that have meaning. Second they would surmise that we derive pleasure (perhaps even some physical or spiritual benefit) from listening to these sounds. Our enjoyment depends upon sounds having been given form, which shows our capacity for inferring design.

This fugue would demonstrate our preference for designs that develop a subject by a process that follows rules, some of which are rooted in the physics of sound, with others having been self-imposed. The imposed rules would be of special interest, as they would confirm a creative tendency. We have the freedom to change the rules in order to invent a wide variety of things that would not exist by deterministic means.

In apprehending our self-imposed limitations, space beings would know that we

² I have since learned that the biologist and author, Lewis Thomas, probably began the “bragging.” When Sagan asked him what music to include, Thomas replied: “I would send the complete works of Johann Sebastian Bach. But that would be boasting.” Thomas is also reported to have suggested: “I would vote for Bach, all of Bach, streamed out into space, over and over again. We would be bragging of course, but it is surely excusable to put the best possible face on at the beginning of such an acquaintance. We can tell the harder truths later.”

are rational and that we have powers of discrimination. We can analyze, synthesize, and evaluate. This fugue is the product of choices we have made to create one thing and not another—we have not done just anything that popped into our heads. The guiding principle behind each choice is to make what is both pleasurable to the ear, and meritorious in form. The aliens would so learn that we make distinctions between good and bad, beautiful and ugly.

Realizing that we make such distinctions, the space creatures would seek to understand the basis upon which we call things beautiful. In hearing this fugue they would discover one criterion sounding from nearly every measure. Beauty is a function of the extent to which there is equilibrium of unity with variety. We do not like too much sameness, but neither do we like too much differentness. We prefer balance.

This fugue would teach the aliens that we create balance by means of contrast. The first four measures have two parts: a disjunct beginning in pitches of varied durations, and a conjunct ending of uniformly short durations. At first making neither head nor tail of this, they might eventually decide to call these parts Alpha α (blue) and Omega Ω (gold).

Upon closer examination they would discover that Alpha and Omega are perfectly balanced—the amount of energy devoted to one is equal to the other.

They would also find that the fugue develops α and Ω in three ways: in series (what we call *subject*), simultaneously (*subject* with *countersubject*), and in repeating patterns (*sequential imitations*). Another balancing act involves switching of registers (*contrapuntal inversion*).

Finally they would understand that everything in the fugue is about exploring Alpha and Omega. The fugue's beginning contains its end, and its end the beginning. Its parts reflect the whole, and the whole reflects its parts. In understanding this they will have realized that the meaning of fugue is to *arrive where we started and know the place for the first time*.

What We Value and Believe

The most important lesson that a space dweller would learn from this fugue is that it exists because we wanted it to. It did not just happen. Presuming them to be as intelligent as us, they would know of no deterministic process whereby this fugue could have unintentionally “happened.” It was created on purpose, and for a purpose.

The aliens would also know that we wanted them to know that we know this—hence the Golden Record and Sagan's choice to include this fugue on it. They would sense that we brought it into existence, and that we purposefully shared it with them because it represents what we value and love.

Would you agree that few of these conclusions are arrived at by materialistic means? In a minute I'll explain what *materialism* means. For now let's ask, how many of these assumptions are intuitive? Practically all of them! While spacelings might apply scientific methods to explain the acoustics of the fugue, they would make most of the foregoing conclusions in quite another way: by listening to it and

forming opinions about it.

Science can explain many things, but not everything. In our culture, which has put great confidence in science, it should concern us that it cannot answer the most important questions like: what is the self, or free will, and what are we here for? The most elemental question that science cannot answer is, why is there something instead of nothing? Why is there a fugue rather than no fugue?

Answering these questions requires assumptions, which lead to inferences that compose the basis for beliefs about the world and our place in it. Although we have been conditioned to believe that science makes no assumptions, it surely does. We call them theories—ideas upon which science operates without proof. When proof arrives, we call them facts.

In the case of this fugue, the aliens might theorize that we created it. If predisposed *not* to believe in creation, they might theorize that the fugue washed from the ocean and that we found it on the beach one day. Both of these theories are based upon assumptions, but (from our vantage point) only one is plausible. One has the greater power of explanation, and is therefore rational. The other is not. In this manner, the extraterrestrial intelligence would be entirely wise to place “faith” (if you please) in the prior assumption, and *not* the latter.

Analogous to Evolution?

Carl Sagan’s fascination with fugue is found in another of his famous works: the thirteen-hour *Cosmos* series broadcast by PBS in 1980. Sagan titled Part 2 of the series, “One Voice in the Cosmic Fugue,” an explanation of DNA and how (he presumed) life on earth evolved from inanimate materials. Sagan continued the musical analogy in Part 3: “The Harmony of the Worlds” where he contrasted pre-scientific human understanding of the universe with that of modern scientific theory.

Sagan’s metaphor—evolution as fugue—assumes that all life is a variation on a theme. Life is the subject, and it must (if like a fugue) reappear in various developments at other times and places. Sagan argued that, because life exists on earth, it *must surely* exist elsewhere.

It is important to recognize that Sagan’s argument is metaphorical and not scientific. He had no evidence that life exists elsewhere. He was, as we will shortly discover, “hopeful.” Sagan believed it, and that belief influenced his thinking, if not his science.

There is nothing wrong with this, of course! All scientists have dogmas, and their discoveries often begin with strong beliefs, or “hunches,” *before* the formulation of any theory. But there exists a particular marriage of belief with science that merits our attention now. It is called *materialism*, which is a cosmological assumption—a belief or faith—that everything in the universe is composed of matter and energy. There is nothing else. Materialism is not science, but an assumption, and it is the foundation upon which most science works today. While not all scientists are materialists, Carl Sagan clearly was.

Sagan believed that if we are able to observe the current state of anything we should be able to determine its past and future states (a theory that had been

called into question by the discovery of quantum mechanics at about the time he was born). In other words, he was committed to a *deterministic* view of the universe—an approach that often accompanies materialism.

The determinist would argue, as did Sagan, that if the fugue's subject (life) evolved by a random mix of materials on earth, it can't help but have restated itself in the presence of those ingredients *wherever* they exist.³ The prospect of life having evolved only on earth was, for Sagan, a dismal thought—like a fugue that states its subject only once, never to return. This thought troubled Sagan because it was seen as a waste of energy—a waste that would call into question one of his most basic assumptions (more about that later).

But this is not the lesson of the fugue. Instead the fugue teaches us that the universe is *more* than energy and matter. Before applying his pencil to paper (energy to matter), Bach must have had a thought. And it was *that thought* that brought the fugue into existence.

Now the materialist would argue that the thought itself is matter and energy—a biochemical reaction, that's all. But this is a typically determined way of thinking about thought. Historically, humans have preferred a rhetorical meaning; "the thought" exists in order to persuade and to convince. This means that the thought has purpose and logic—concepts that are as far removed from matter and energy as the Earth is from Sagittarius.

If this topic interests you, consider reading more about the rhetorical implications of music in the dm fugue of book 1. As for logic, study the comparison of the fugue in C# Major (book 2) to Gödel's theorem of incompleteness. These analyses demonstrate how the universe is not limited to material; it includes symbolic systems like math, language, and the music of J. S. Bach!

As with the fugue, where thought preceded energy and matter, a thoughtful design may have shaped the universe. In this sense, Sagan's search for extraterrestrial intelligence may have been intuitively correct, but misdirected. Instead of searching for intelligence that the universe created, might he have sought the intelligence that created the universe?

³ Sagan's hunch has since been called into question by the "anthropic principle," which is the consensus of nearly all physicists today. On Nov. 25, 2016 Howard Smith, senior astrophysicist at the Harvard-Smithsonian Center for Astrophysics wrote for the Washington Post:

The universe, far from being a collection of random accidents, appears to be stupendously perfect and fine-tuned for life. The strengths of the four forces that operate in the universe — gravity, electromagnetism, and the strong and weak nuclear interactions (the latter two dominate only at the level of atoms) — for example, have values critically suited for life, and were they even a few percent different, we would not be here. The most extreme example is the big bang creation: Even an infinitesimal change to its explosive expansion value would preclude life. The frequent response from physicists offers a speculative solution: an infinite number of universes — we are just living in the one with the right value. But modern philosophers such as Thomas Nagel and pioneering quantum physicists such as John Wheeler have argued instead that intelligent beings must somehow be the directed goal of such a curiously fine-tuned cosmos.

Filled with Hope

Explaining the purpose of his Golden Record, Carl Sagan wrote that, “The spacecraft will be encountered and the record played only if there are advanced spacefaring civilizations in interstellar space. But the launching of this bottle into the cosmic ocean says something very hopeful about life on this planet.”

Although Sagan believed that intelligent beings have evolved elsewhere, his words betray doubt as to whether they would find his Rosetta Stone. Given the improbability of a spacefaring civilization ever capturing this fugue, his Golden Record has more to do with us than them. The more important question is not what might they learn of us, but what might we learn of ourselves.

Sagan believed that the time capsule says, “something very hopeful about life on this planet.” His first lesson is that we are hopeful beings. As to what is hoped for, his statement does not tell. On the basis of other commentary we know that Carl Sagan hoped for peace and tranquility. He hoped that our planet and civilization, including great works like this fugue, would survive. His time capsule was not a desperate Noah’s ark, but a reminder of the treasure and fragility of life on Earth.

While we should admire his impulse to preserve life, Sagan’s hopefulness is quite irreconcilable with a materialistic universe. If everything is matter, shaped by inexorable and determined energies, of what use is hope? How could any such hope affect the outcome? Are we to hope that the accidental collision of forces that produced us will also sustain us? Is our hope in Chance? Is that even rational?

Inasmuch as it was Dr. Sagan’s choice to include this fugue on his Golden Record, and to compare evolution to a “grand cosmic fugue,” it is important to point out that his metaphor contains a disturbing contradiction. His hopefulness implies free will, whereas his science denied that such a thing could exist. Matter has no will of its own, and energy is not free to do as it pleases.

The contradiction is this. If the study of Bach teaches anything about The Fugue, it is the principle of planning, forethought and design. His fugues are neither materialistic nor deterministic. They didn’t just happen. Given random mixes of rhythms, pitches, and counterpoint, a fugue will never “happen,” billions of years notwithstanding.

The Fugue needed a Creator. Bach evaluated the options that presented themselves while composing this fugue. He chose the best—the ones that pleased him and that he thought would please others. The Composer was not indifferent toward his Fugue. Bach brought it through various drafts and assembled it with other fugues for publication. He even gave the cycle a purpose: “For the use and improvement of musical youth eager to learn, and for the particular delight of those already skilled in this discipline” [from the 1722 title page of the *WTC*].

Whereas Sagan’s evolution-as-fugue metaphor is contradictory, he provided a more satisfying analogy in *Contact*, his most popular work. The novel’s heroine, SETI researcher Ellie Arroway (played in the movie by Jodie Foster), finds herself in receipt of a radio signal from the star Vega. From a distance of twenty-six light years, the signal had been broadcast on a frequency equal to Pi times the value of

hydrogen, counting in prime numbers from 1 to 101—a binary code.

Following instructions in later messages, Arroway builds a machine that transports her to a Vegan planet where she meets an intelligent being that projects itself (speaking English) in the image of her father. She returns to face a congressional investigation. With no material proof of her encounter, she passionately asks the assembled senators to place some measure of faith in her account, and *believe* that intelligent life exists elsewhere in the universe.

How like this fugue! Its frequencies are not the cosmic noise of the universe, but ordered and defined. It transmits a sequence of contextually differentiated subjects. We infer that it emanates from an intelligent being and follow the course of its signal to an encounter with Johann Sebastian Bach—right here on planet Earth!

How like a fugue too was the life and work of Carl Sagan. His dream of finding extraterrestrial intelligence was the subject. He developed it in his Golden Record, *Cosmos* series, and only novel, *Contact*.

One wonders, with so much intelligent life on his own planet, why was Dr. Sagan so desirous of finding it elsewhere? Of course we are all curious, but Carl Sagan's devotion to this subject exceeded curiosity. His keen interest undoubtedly had many reasons, but we shall consider, and conclude with, two.

First, not to believe in life elsewhere calls into question one of the cardinal rules of a materialistic universe: waste implies misdirected design. This would be like a piece of music that states an idea once, then wanders about in a futile search for an opportunity to state it again—i.e. a lot of music, but not a fugue. By contrast, the fugue manifests not only design, but also an economy of means unparalleled in any other form.

Raymond Bohlin has noted Sagan's concern for misdirected design by observing that he repeated a telling line three times in the novel *Contact*. Arroway's father replies to her question about intelligent life in the universe with, "If there isn't it would be an awful waste of space." As an adult, Arroway hears these same words spoken independently by her fellow SETI researcher, Palmer Joss. Toward the end of the novel, Ellie repeats these words to a group of school children.

Dr. Bohlin summarized the problem this way: "If the universe was created for us and we are alone, why does it have to be so big? Surely we could have survived quite well in a much smaller and economical universe."

The implication of Sagan's wasted-space argument is that the universe is indifferent toward us. More than indifferent, it is utterly ignorant. We are an accident of chance. Sagan explicitly endorses this belief in his *Cosmos* series.⁴ The universe shows its indifference by not wasting space on us. Instead it produces life whenever conditions are right, thereby assuring us that we are nothing out of the ordinary. The universe must do this, or else human life is unique.

Although one cannot help but admire Carl Sagan for having devoted profound

⁴ Sagan said, "We live on an insignificant planet of a humdrum star" (*Cosmos* episode 7, "The Backbone of Night") while Stephen Hawking calls humankind "a chemical scum on a moderate-sized planet."

thought to this problem, it should trouble us none to think that life might exist only on our speck of the universe. This should trouble us no more than the thought that this particular fugue has not been repeatedly composed at other times and places in the universe. While Sagan's theory seems plausible in the case of life (because we have been highly conditioned to think it so), it seems implausible in the case of The Fugue.

One cannot fathom a Baroque fugue spontaneously springing into existence no matter how much time, or how propitious the circumstance. Nor can one believe that an alien happening to live in a world like ours might someday independently compose (perhaps already has) a Bach fugue. Yet how infinitely more complex is life than a fugue!

Second, Sagan may have focused upon finding extraterrestrial intelligence because of the universal belief that it is not good to be alone. This belief emanates not from the assumptions of scientific materialism, but from our common need for sustenance: physical, emotional, and spiritual. This need was poignantly expressed in another movie, *Shadowlands*, where C. S. Lewis refrains from reprimanding a student caught stealing his books. Instead Lewis commends the student's love for literature by agreeing with him: "We read to know we're not alone."

What is The Fugue's purpose? Whether it is in Sagan's Search for Extraterrestrial Intelligence (SETI), or the music of Bach, or the writings of C. S. Lewis, it is to know that we are not alone. The place where we are least alone is right here on planet Earth where we shall, in the words of T. S. Elliot, *arrive where we started and know the place for the first time*.

The heavens declare the glory of God;
the skies proclaim the work of his hands.
Day after day they pour forth speech;
night after night they reveal knowledge.
They have no speech, they use no words;
no sound is heard from them.
Yet their voice goes out into all the earth,
their words to the ends of the world.

For the director of music.
A psalm of David. (Psalm 19)