The Source of Music

Only those who will risk going too far can possibly find out how far one can go.

—T. S. Eliot

The ballet began at eight. It had been a hot and humid summer day in Paris, and the night remained uncomfortably sultry. The inside of the theater was stifling. As the houselights dimmed, the audience, a little tipsy from their pretheater drinks, put down the programs and stopped murmuring. The men removed their top hats and blotted their foreheads. The ladies unfurled their boas. The curtain slowly rose.

Igor Stravinsky, sweating in his tuxedo in the fourth row, was getting nervous. The ballet The Rite of Spring, for which he had written the music, was about to receive its public premiere. An ambitious young composer, Stravinsky was eager to advertise his genius to the cosmopolitan crowd. He wanted his new work of music to make him famous, to be so shockingly new that it could not be forgotten. Modern times demanded modern sounds, and Stravinsky wanted to be the most modern composer around.

The first dance that night was not The Rite. Sergei Diaghilev, the impresario of the Ballets Russes and the man who had commissioned Stravinsky's composition, chose to start the evening with a classic, Les Sylphides. With piano music by Chopin and choreography by the always graceful Michel Fokine, this crowd-pleasing polonaise represented everything Stravinsky rebelled against. Fokine had been inspired by Chopin's dreamy harmonies and turned the ballet into a reverie of romanticism, a work of pure poetic abstraction. Its only plot was its beauty.

There was no intermission following the piece. After the applause faded, the auditorium filled with a pregnant pause. A few more percussionists crammed into the pit. The string players dutifully retuned their instruments. When they were finished, the conductor, Pierre Monteux, moved his baton to the ready position. He pointed to the bassoon player. The Rite had begun.

At first, The Rite is seductively easy. The tremulous bassoon, playing in its highest register (it sounds like a broken clarinet), echoes an old Lithuanian folk melody. To the
innocent ear, this lilting tune sounds like a promise of warmth. Winter is over. We can hear the dead ground giving way to an arpeggio of green buds.

But spring, as T. S. Eliot pointed out, is also the cruellest time. No sooner do lilacs emerge than the sweeping dissonance of Stravinsky's orchestral work begins, like "the immense sensation that all things experience at the moment when Nature renews its forms." In one of music's most brutal transitions, Stravinsky opens the second section of his work with a monstrous migraine of sound. Though the music has just started, Stravinsky is already relishing the total rejection of our expectations. Stravinsky called this section "The Augurs of Spring."

The "Augurs" don't augur well. Within seconds, the bassoon's flowery folk tunes are paved over by an epileptic rhythm, the horns colliding asymmetrically against the ostinato. All of spring's creations are suddenly hollering for attention. The tension builds and builds and builds, but there is no vent. The irregular momentum is merciless, like the soundtrack to an apocalypse, the beat building to a fatal fortissimo.

This was when the audience at the premiere began to scream. The Rite had started a riot.

Once the screaming began, there was no stopping it. After being pummeled by the "Augurs" chord, the bourgeoisie began brawling in the aisles. Old ladies attacked young aesthetes. Insults were hurled at ballerinas. The riot got so loud that Monteux could no longer hear what he was conducting. The orchestra disintegrated into a cacophony of confused instruments. Musical dissonance was usurped by real dissonance. The melee incensed Stravinsky. His art was being destroyed by an idiotic public. His face etched with anger, Stravinsky fled from his seat and ran backstage.

In the wings was Diaghilev, frantically switching the houselights on and off, on and off. The strobe effect only added to the madness. Vaslav Nijinsky, the ballet's choreographer, was just off the stage, standing on a chair and shouting out the beat to the dancers. They couldn't hear him, but it didn't matter. After all, this dance was about the absence of order. Like the music, Nijinsky's choreography was a self-conscious rejection of his art. The refined, three-dimensional shapes of the academic ballet, the discrete positioning of the arms and legs, the ballon, the sensuous embraces, the turned-out feet, the tutus—all of dance's traditions were ridiculed. Under Nijinsky's direction, the audience saw only the dancers' profiles, their bodies hunched over, their heads hanging down, their turned-in feet hammering the wooden stage. The dancers later said the dance jarred their organs. It was a ballet as furiously new as the music.

The Parisian police eventually arrived. They only caused more chaos. Gertrude Stein
described the scene: "We could hear nothing ... The dancing was very fine and that we could see although our attention was constantly distracted by a man in the box next to us flourishing his cane, and finally, in a violent altercation with an enthusiast in the box next to him, his cane came down and smashed the opera hat the other had just put on in defiance. It was all incredibly fierce." The furor didn't end until the music stopped.

If there was any consolation from the violence that night, it was the publicity. Stravinsky's orchestral work was the talk of the town. He was suddenly cooler than Colette. Stravinsky would later remember the night as bittersweet. No one had heard his art, but he had become a genuine celebrity, the icon of the avant-garde. When the performance was over and the theater was empty, Diaghilev said only one thing to Stravinsky: "Exactly what I wanted."

Why did the crowd riot that night? How could a piece of music move a crowd to violence? This is The Rite's secret. For the audience, Stravinsky's new work was the sound of remorseless originality. The crowd was expecting more Chopin. What they got instead was the gory birth of modern music.

The source of this pain is literally visible in the score. Stutterings of notes fill page after page. Densities of black, clots of sound. Pure, painful sonority, interrupted only by some spooky clarinet solo off in the distance. Even the instrumentation of The Rite insults the symphonic tradition. Stravinsky ignored the string instruments, the workhorse of the romantic composer. He found their fragile sound too much like a human voice. He wanted a symphonic sound without people, the sound of music "before the arising of Beauty."

Stravinsky created this effect by conceding nothing to his audience. He disfigured its traditions and dismantled its illusions. While the crowd at the premiere assumed that beauty was immutable—some chords were just more pleasing than others—Stravinsky knew better. An instinctive modernist, he realized that our sense of prettiness is malleable, and that the harmonies we worship and the tonic chords we trust are not sacred. Nothing is sacred. Nature is noise. Music is nothing but a sliver of sound that we have learned how to hear. With The Rite, Stravinsky announced that it was time to learn something new.

This faith in our mind's plasticity—our ability to adapt to new
kinds of music—was Stravinsky's enduring insight. When he was first composing The Rite, in Switzerland, testing out its dissonant chords on his piano, a young neighborhood boy got into the habit of yelling, "That's wrong!" at his window. Stravinsky just shrugged. He knew the brain would eventually right his wrongness. The audience would adapt to his difficult notes and discover the beauty locked inside his art. As neuroscience now knows, our sense of sound is a work in progress. Neurons in the auditory cortex are constantly being altered by the songs and symphonies we listen to. Nothing is difficult forever.

The Birth of Dissonance

Igor Stravinsky was born in 1882, the third son of minor nobles. His father was a St. Petersburg opera singer. Although his family insisted that he go to law school, Stravinsky hated law. The legal system embodied everything he found tedious: rules, forms, judges. Suffering through his classes, the young Igor steeped himself in angst. He would later describe his childhood "as a period of waiting for the moment when I could send everyone and everything connected with it to hell."

That moment arrived when his father died. Igor was now free to quit law school. He quickly joined the music academy of Nikolai Rimsky-Korsakov, the only important teacher he would ever have. Like the mature Stravinsky, who made modern symphonies by recycling old folk tunes, Korsakov was a composer defined by his contradictions. He was a Russian nationalist who loved German music, a czarist with a soft spot for the fin-de-siècle.

At the conservatory in St. Petersburg, Korsakov indoctrinated Igor into the anxiety of the modern composer. The problem facing modern music, Korsakov said, was simple: orchestral music had become boring. Wagner's vaunted ambition had been largely replaced by cheerful pastiche, most of it written for the ballet. (In his typical fashion, Wagner blamed this trend on the Jews.) Even more worrying, the modernist revolution seemed to be leaving composers behind. Painters were busy discovering abstraction, but music was already abstract. Poets were celebrating symbolism, but music had always been symbolic. Music could get no grander than The Ring Cycle and no more precise than Bach. The modern composer was trapped by the past. For this reason, the revolution in sound would have to begin with an act of deconstruction. As Wagner had declared half a century earlier when he embarked on his own violent renovation of musical style, "Works of art cannot be created at present, they can only be prepared for by means of revolutionary activity, by destroying and crushing everything that is worth destroying and crushing."*
The modernist coup d'état occurred in 1908, when Arnold Schoenberg decided to abandon the structure of classical music. As an act of aesthetic revolt, this was equivalent to a novelist abandoning plot. Before Schoenberg, every symphony followed a few simple rules. First, the composer introduced the tonic triad, a chord of three notes. This chord was the invisible center of the music, the gravitational force that ordered its unfolding. Next, the composer carefully wandered away from the tonic triad, but never too far away. (The greater the acoustic distance from the tonic, the greater the dissonance, and too much dissonance was considered impolite.) The music always concluded with the tonic's triumphant return, the happy sound of a harmonic ending.

Schoenberg found this form suffocating. He wanted the structure of his music to reflect his own expressive needs and not the stuffy habits of some "mediocre kitschmonger." He began daydreaming of "the day when dissonance will be emancipated," when the symphony would be set free from the easy clichés of the eight-note scale. "If I must commit artistic suicide," Schoenberg said, "then I must live by it."

This suicide by atonality finally happened in the middle of Schoenberg's String Quartet no. 2 in F-sharp Minor, written in 1908. The quartet is a study of tonal entropy: we hear the slow decay of the F-sharp minor key. By the third movement of the string quartet, about the time a soprano begins to sing, "I am only a roaring of a prophetic voice," the tonal structure has been completely obliterated. No single harmonic endures for more than a few flirtatious seconds. The work as a whole is guided only by its parts. Classical music has been deconstructed.

In the program that night, Schoenberg tried to explain the logic behind his "pandemonium." He needed freedom from form because musical form had ceased to mean anything. "The overwhelming multitude of dissonances" could no longer be suppressed or censored. Schoenberg was finished following everyone else's rules. It was time to write his own.

When Stravinsky first heard Schoenberg, he immediately recognized the older musician's importance. A line had been crossed. The composer was now free to express anything, even ugly things. Stravinsky wrote in an early letter, "Schoenberg is one of the greatest creative spirits of our era."

The Viennese public did not agree. Even before Schoenberg completely abandoned tonality, his compositions stretched the limits of good taste. His riff on Wagner, Verklärte Nacht (Transfigured Night), written in the 1890s, was banned by a Viennese musical society because it contained an unknown dissonance. The prim society didn't realize that
Schoenberg was only interested in unknown sounds. If a dissonant sound was known, then it wasn't dissonant enough. Schoenberg liked to use chemistry as a metaphor for his music, a science in which tiny alterations can create an inordinately potent chemical. "One atom of hydrogen more, one less of carbon," Schoenberg wrote, "changes an uninteresting substance into a pigment or even an explosive."

By 1913—the year of The Rite—Schoenberg had discovered how to make musical dynamite. His art wasn't just atonal; it was painfully atonal. During a concert performance of his Chamber Symphony no. 1, opus 9, just two months before the premiere of The Rite, the fragile relationship between the composer and his public finally imploded. Schoenberg's audience rebelled against his newness, screaming at the stage and forcing the police to be called and the program to be canceled.* Doctors declared, on behalf of traumatized listeners, that his atonality caused emotional and psychic distress. The tabloids were filled with headlines about lawsuits and fistfights. Schoenberg was unrepentant: "If it is art, it is not for all, and if it is for all, it is not art."

Petrushka was Stravinsky's first major work to follow in the brazen path of Schoenberg's avant-garde. But Stravinsky, unlike Schoenberg, did not undermine tonality by erasing it. He worried that atonality was too stifling, and that Schoenberg, with all his "rationalism and rules," might end up becoming "a dolled-up Brahms." Instead, Stravinsky decided to torment his audience by making it overdose on tonality. In Petrushka, a Diaghilev ballet about a puppet who comes to life, Stravinsky took two old folk melodies and set them against each other, like wind-up dolls. As a result, the music is bitonal, unfolding in two keys (F-sharp major, which is almost all black keys, and C major, which is all white keys) simultaneously. The result is unresolved ambiguity, the ironic dissonance of too much consonance. The ear must choose what to hear.

Waves of Noise

Our sense of sound begins when a sound wave, hurtling through space at 1,100 feet per second, collides with the eardrum. This shudder moves the tiniest three bones in the body, a skeleton locked inside the ear, pressing them against the fluid-filled membranes of the cochlea. That fluid transforms the waves of compressed air into waves of salty liquid, which in turn move hair cells (so named because they look like microscopic bristles). This minute movement opens ion channels, causing the cells to swell with electricity. If the cells are bent at a sharp enough angle for long enough, they fire an electrical message onward to the brain. Silence is broken. Sound has begun.

The cochlea is quilted with 16,000 of these neurons. In a noisy world, they are ceaselessly being bent. The air is filled with vibrations, and every vibration reverberates inside the echo chamber of the ear. (Hair cells are sensitive to sounds of atomic dimensions. We can literally hear Brownian motion, the random jostle of atoms.) But how, out of this electrical cacophony, do we ever hear a coherent sound?
The answer is anatomical. Hair cells are arranged like the keys on a piano. On one end, they are tuned to respond to high-frequency sounds, while at the other end they are bent by the throb of low frequencies. When a scale is played, the hair cells mirror the escalating notes. They sway in time with the music, deftly translating the energy of noise into a spatial code of electricity.

And while every sound starts as a temporary pattern of hair cells, that's only the beginning of listening. In the time it takes to play a sixteenth note, the sensory rumors heard by the ear are rehearsed again and again inside the brain. Eventually, the sound reaches the primary auditory cortex, where neurons are designed to detect specific pitches. Instead of representing the full spectrum of sound waves vibrating inside the ear, the auditory cortex focuses on finding the note amid the noise. We tune out the cacophony we can't understand. (This is why we can recognize a single musical pitch played by different instruments. Although a trumpet and violin produce very different sound waves, we are designed to ignore these differences. All we care about is the pitch.) When these selective neurons in the auditory cortex become excited, the vague shudders of air finally become a musical note.

But a work of music is not simply a set of individual notes arranged in time. Music really begins when the separate pitches are melted into a pattern. This is a consequence of the brain's own limitations. Music is the pleasurable overflow of information. Whenever a noise exceeds our processing abilities—we can't decipher all the different sound waves hitting our hair cells—the mind surrenders. It stops trying to understand the individual notes and seeks instead to understand the relationships between the notes. The human auditory cortex pulls off this feat by using its short-term memory for sound (in the left posterior hemisphere) to uncover patterns at the larger level of the phrase, motif, and movement. This new approximation lets us extract order from all these notes haphazardly flying through space, and the brain is obsessed with order. We need our sensations to make sense.

It is this psychological instinct—this desperate neuronal search for a pattern, any pattern—that is the source of music. When we listen to a symphony, we hear a noise in motion, each note blurring into the next. The sound seems continuous. Of course, the physical reality is that each sound wave is really a separate thing, as discrete as the notes written in the score. But this isn't the way we experience the music. We continually abstract on our own inputs, inventing patterns in order to keep pace with the onrush of noise. And once the brain finds a pattern, it immediately starts to make predictions, imagining what notes will come next. It projects imaginary order into the future, transposing the melody we have just heard into the melody we expect. By listening for patterns, by interpreting every note in terms of expectations, we turn the scraps of sound into the ebb and flow of a symphony.

The Tension of Emotion
The structure of music reflects the human brain's penchant for patterns. Tonal music (that is, most baroque, classical, and romantic music) begins by establishing a melodic pattern by way of the tonic triad. This pattern establishes the key that will frame the song. The brain desperately needs this structure, as it gives it a way to organize the ensuing tumult of notes. A key or theme is stated in a mnemonic pattern, and then it is avoided, and then it returns, in a moment of consonant repose.

But before a pattern can be desired by the brain, that pattern must play hard to get. Music only excites us when it makes the auditory cortex struggle to uncover its order. If the music is too obvious, if its patterns are always present, it is annoyingly boring. This is why composers introduce the tonic note in the beginning of the song and then studiously avoid it until the end. The longer we are denied the pattern we expect, the greater the emotional release when the pattern returns, safe and sound. The auditory cortex rejoices. It has found the order it has been looking for.

To demonstrate this psychological principle, the musicologist Leonard Meyer, in his classic book *Emotion and Meaning in Music* (1956), analyzed the fifth movement of Beethoven's String Quartet in C-sharp Minor, opus 131. Meyer wanted to show how music is defined by its flirtation with—but not submission to—expectations of order. He dissected fifty measures of Beethoven's masterpiece, showing how Beethoven begins with the clear statement of a rhythmic and harmonic pattern and then, in an intricate tonal dance, carefully avoids repeating it. What Beethoven does instead is suggest variations of the pattern. He is its evasive shadow. If E major is the tonic, Beethoven plays incomplete versions of the E major chord, always careful to avoid its straight expression. He preserves an element of uncertainty in his music, making our brains beg for the one chord he refuses to give us. Beethoven saves that chord for the end.

According to Meyer, it is the suspenseful tension of music (arising out of our unfulfilled expectations) that is the source of the music's feeling. While earlier theories of music focused on the way a noise can refer to the real world of images and experiences (its connotative meaning), Meyer argued that the emotions we find in music come from the unfolding events of the music itself. This "embodied meaning" arises from the patterns the symphony invokes and then ignores, from the ambiguity it creates inside its own form. "For the human mind," Meyer wrote, "such states of doubt and confusion are abhorrent. When confronted with them, the mind attempts to resolve them into clarity and certainty." And so we wait, expectantly, for the resolution of E major, for Beethoven's established pattern to be completed. This nervous anticipation, says Meyer, "is the whole raison d'etre of the passage, for its purpose is precisely to delay the cadence in the tonic." The uncertainty makes the feeling. Music is a form whose meaning depends upon its violation.
Stravinsky's music is all violation. While the cultured public thought music was just a collection of consonant chords played in neat meter, Stravinsky realized that they were wrong. Pretty noises are boring. Music is only interesting when it confronts us with tension, and the source of tension is conflict. Stravinsky's insight was that what the audience really wanted was to be denied what it wanted.

The Rite was the first symphonic work to express this antagonistic philosophy. Stravinsky anticipated the anticipations of his audience and then refused them every single one. He took the standard springtime song and made art out of its opposite. Dissonance never submits to consonance. Order does not defeat disorder. There is an obscene amount of tension, but it never gets resolved. Everything only gets worse. And then it ends.

To our sensitive nerves, such a musical work feels like an affront. The brain—an organ of synaptic habit—is hopelessly frustrated. We begin identifying with the violent sacrificial dance on stage. This was Stravinsky's intention: his music was a blatant provocation. Needless to say, it worked. But why? How did Stravinsky engineer so much agony into his art?

The answer to this question returns us to the idea of order. Although music begins with our predilection for patterns, the feeling of music, as Meyer noted, begins when the pattern we imagine starts to break down. The Rite, of course, is one long breakdown. Stravinsky didn't just invent some new musical patterns; he insisted on murdering our old ones. He introduced fragments of folk songs, then destroyed them with a gunshot of chromatic bullets. He took the big sonoric brushstrokes of major chords and put them through a cubist machine. Strauss is punked, Wagner is inverted, Chopin is mocked. Classicism is made cynical.

The sadistic newness of The Rite's patterns, its stubborn refusal to conform to our learned expectations, is the dirty secret of its discontent. By disobeying every rule we think we know, Stravinsky forces us to confront the fact that we have expectations, that the mind anticipates certain types of order, followed by certain types of release. But in The Rite, these expectations are rendered useless. We do not know what note will come next. And this makes us angry.

The emotions generated by musical tension—a tension taken to grotesque heights by Stravinsky—throb throughout the body. As soon as the orchestra starts to play, the flesh undergoes a range of changes. The pupils dilate, pulse and blood pressure rise, the electrical conductance of the skin lowers, and the cerebellum, a brain region associated with bodily movement, becomes unusually active. Blood is even redirected to the leg muscles. (As a result, we begin tapping our feet in time with the beat.) Sound stirs us at
our biological roots. As Schopenhauer wrote, "It is we ourselves who are tortured by the strings."

Stravinsky, of course, knew exactly how to raise our blood pressure. At first glance, this might seem like a dubious achievement. Must modern art really be so cruel? Whatever happened to beauty? But Stravinsky's malevolence was rooted in a deep understanding of the mind. He realized that the engine of music is conflict, not consonance. The art that makes us feel is the art that makes us hurt. And nothing hurts us like a pitiless symphony.

Why is music capable of inflicting such pain? Because it works on our feelings directly. No ideas interfere with its emotions. This is why "all art aspires to the condition of music." The symphony gives us the thrill of uncertainty—the pleasurable anxiety of searching for a pattern—but without the risks of real life. When we listen to music, we are moved by an abstraction. We feel, but we don't know why.

Stravinsky the Hipster

Stravinsky originally composed the "Augurs" section—the awful sound that started the riot—at a piano. One hand played the E major chord, and the other hand played the E-flat-major-seventh chord. He beat these sounds into the ivory and ebony keys, the rhythm as insistent as an alarm clock. To this headache he added some syncopated accents. The terror now had a groove. When Diaghilev first heard the "Augurs" section, he asked Stravinsky a single question: "How long will it go on like that?" Stravinsky's answer: "To the end, my dear." Diaghilev winced.

The irony is that the terrible beauty of the "Augurs" chord is not really dissonant. The sound is actually composed of classic tonal chords set against each other, in dissonant conjunction. Stravinsky melts together two separate harmonic poles, which has a short-circuiting effect. The ear hears shards of harmony (E, E-flat, C), but the brain can't fit the shards together. How come?

Because the sound is new. Stravinsky electrified the familiar. Never before in the history of music had a composer dared to confront us with this particular shiver of compressed air, played with this kind of naked staccato. The brain is befuddled, its cells baffled. We have no idea what this sound is, or where it might go, or what note will come next. We feel the tension, but we can't imagine the release. This is the shock of the new.

Stravinsky worshipped the new. "Very little tradition lies behind Le Sacre du Printemps" he would later brag. "And there is no theory. I had only my ear to help me." Stravinsky believed that music, like nature, required constant upheaval. If it wasn't original, then it wasn't interesting. As a result, Stravinsky spent his career constantly reinventing himself, divvying up his life into distinct stylistic periods. First, there is Stravinsky the modernist, the musical equivalent of Picasso. When that got boring,
Stravinsky rebranded himself as a satirist of the baroque. From there, he ventured into
minimalism, which morphed into neoclassicism, which became, at the end of his life, a
Schoenbergian-sounding serialism. There was scarcely an -ism he hadn't explored.

Why didn't Stravinsky stay the same? As Bob Dylan, another musical chameleon,
once remarked, "He not busy being born is busy dying." Stravinsky's greatest fear was
dying the slow death of predictability. He wanted every one of his notes to vibrate with
surprise, to keep the audience on edge. He believed that sheer daring—as opposed to
beauty or truth—was "the motive force of the finest and greatest artist. I approve of
daring: I set no limits to it."

Stravinsky's impudence manifested itself everywhere in his music. He never met a
rhythm he didn't want to syncopate or a melody he wasn't compelled to mock. But
Stravinsky's urge to unsettle was most evident in his avoidance of the musical patterns of
the past. He knew that over time the dissonance of newness became consonant. The
mind learned how to interpret the obscure noise. As a result, the symphony ceased to be
scary.

Stravinsky himself had nothing against major chords or the charming patterns of the
past. In fact, The Rite is full of consonant pitches and allusions to old Russian folk tunes.
But Stravinsky needed tension. He wanted his music to seethe with stress, with the Sturm
und Drang of originality. And the only way to create that kind of music was to create a
new kind of music, a dissonant sound that the audience didn't know. "I have confided to
my orchestra the great fear which weighs on every sensitive soul confronted with
potentialities" Stravinsky wrote in an introduction to The Rite. It was this sound—the
fearful sound of newness without limits, a form that could potentially become any form—
that Stravinsky heard in the pubescent stirrings of spring.

The problematic balancing act, of course, is being au courant without being
incoherent, difficult but not impossible. Although The Rite was described at its premiere
as an example of pure noise, chaos without cessation, it is actually an intricate quilt of
patterns. Stravinsky was nothing if not meticulous. But the patterns he wove into The
Rite weren't the usual patterns of Western music. The brain didn't know these patterns.
Stravinsky abjured all conventions, and, in this symphonic work, created his own system
of harmony and rhythm. Take the beat of the "Augurs" chord, a rhythm that is usually
described as arbitrary and random. It is actually anything but. Stravinsky uses this
moment to suspend melody and harmony, so that all we hear are the dissonant stabs. He
wants us to focus on the source of our pain.

And while the berating beat of the section pretends to appear abruptly, Stravinsky
has carefully prepared us for its rhythmic throb. Amid the swarming folk melodies of the
introduction, Stravinsky has the violins outline the chord (D-flat, B-flat, E-flat, B-flat) and
the beat (2/4 time), so that when the actual "Augurs" begins we hear their stuttering
accents as either on or off the beat. Their jarring randomness is framed, which (ironically)
only serves to emphasize their randomness. And while Stravinsky is busy destabilizing the beat, using the "Augurs" chord to dismantle the pattern he has just created, he is simultaneously making us—the audience—keep the beat steady. He forces us to project his own peculiar pattern forward in time. In fact, we quickly realize that we are the only source of steadiness: the helpful violins have gone silent. Stravinsky has used our addiction to patterns to give his disorder an order. The order is our own.

This is the method of The Rite. First, Stravinsky throws a wrench into our pattern-making process, deliberately and loudly subverting everything we think we know. (This is the not-so-subtle purpose of the "Augurs" chord.) Then, after clearing our heads of classical detritus, Stravinsky forces us to generate patterns from the music itself, and not from our preconceived notions of what the music should be like. By abandoning the conventions of the past, he leaves us with no pattern but that which we find inside his own ballet music. If we try to impose an outside pattern onto The Rite, if we try to unlock its newness using the patterns of Beethoven or Wagner or Petrushka, those patterns will be hurled back in our faces. Even when we can recognize Stravinsky's notes, their arrangement confuses us, for Stravinsky fragments everything. His imagination was a blender.

All of this novelty leaves us bitterly disoriented. To find the echo of order in The Rite, we have to pay exquisite attention. If we fail to listen carefully, if we tune out its engineered undulations, then the whole orchestra becomes nothing more than a mutiny of noise. The music disappears. This is what Stravinsky wanted. "To listen is an effort," he once said, "and just to hear is no merit. A duck hears also."

But Stravinsky makes it difficult to listen. His orchestrual work is a stampede, and whatever fragile order there is remains hidden. We hear patterns, but barely. We sense a structure, but it seems to exist only in our minds. Is this music? we wonder. Or is this noise? Are these quavers random, or is there a method to their madness? Stravinsky doesn't stop to answer these questions. He doesn't even stop to acknowledge that a question has been asked. The sound just stampedes on.

The sonic result is pure ambiguity, on a terrifying scale. When Stravinsky said that "Music is, by its very nature, essentially powerless to express anything at all," he was alluding to the fact that the epitome of musical expression is uncertainty. If music is not ambiguous then it expresses nothing, and if it expresses something then it has only expressed the absence of certainty. And while many composers before The Rite made a habit of limiting originality—too much newness was too painful—Stravinsky pitilessly ended that aesthetic game. His symphonic music denies us a consonant climax. It mocks our expectations of a happy ending. In fact, it mocks all our expectations.

And so, at the exact moment when every other composer in every other symphony is contemplating the angle of easy repose—the satisfied sound of an orchestra ending with the tonic—Stravinsky decides to kill his virgin with some big timpani drums. He forces her
to dance the impossible dance, giving her a different beat in every musical bar. The rhythmic patterns fly by in a schizophrenic babble: 9/8 becomes 5/8, which becomes 3/8, which abruptly shifts into 2/4–7/4–3/4, and so on. Our cells can sense the chaos here; we know that this particular wall of sound is irresolvable. All we can do is wait. This too must end.

**Plato's Mistake**

What is music? This is the unanswered question at the center of The Rite. The violent crowd at the premiere insisted that the symphonic work was nothing but noise. Whatever music was, this wasn't it. There were limits to newness, and The Rite had crossed the line.

Stravinsky, of course, believed otherwise. He said that noise became music "only by being organized, and that such an organization presupposes a conscious human act." Music, The Rite of Spring shouts, is man-made, a collection of noises that we have learned how to hear. That is all.

This was a radically new definition of music. Ever since Plato, music had been seen as a metaphor for the innate order of nature. We don't make music, Plato said, we find it. While reality appears noisy, hidden in the noise is an essential harmony, "a gift of the Muses." For Plato, this made music a form of medicine, "an ally in the fight to bring order to any orbit in our souls that has become unharmonized." The beauty of the C major chord reflected its rational trembling, which could inspire a parallel rationality inside us.

Plato took the power of art seriously. He insisted that music (along with poetry and drama) be strictly censored inside his imaginary republic. Seduced by the numerical mysticism of Pythagoras, Plato believed that only consonant musical pitches—since they vibrated in neat geometrical ratios—were conducive to rational thinking, which is when "the passions work at the direction of reason." Unfortunately, this meant systematically silencing all dissonant notes and patterns, since dissonance unsettled the soul. Feelings were dangerous.

At first glance, The Rite of Spring seems like perfect evidence for Plato's theory of music. Stravinsky's orchestral dissonance provoked a violent urban riot. This is exactly why the avant-garde must be banned: it's bad for the republic. Better to loop some easy elevator music.

But Plato—for all of his utopian insight—misunderstood what music actually is. Music is only feeling. It always upsets our soul. If we censored every song that filled people with irrational emotions, then we would have no songs left to play. And while Plato only trusted those notes that obeyed his mathematical definition of order, music really begins when that order collapses. We make art out of the uncertainty.
The Rite shattered many myths, but the myth Stravinsky took the most pleasure in shattering was the parable of progress. Stravinsky said, "In music, advance is only in the sense of developing the instruments of the language." While Plato believed that music would one day perfectly mirror the harmony of the cosmos—and thus inspire our souls with the pure sound of reason—Stravinsky's symphonies were monuments to the meaninglessness of progress. In the modernist vision of The Rite, music is simply a syntax of violated patterns. It doesn't become better over time, it just becomes different.

Stravinsky's version of progress was borne out by what happened after the riot. Although that first audience screamed at the stage, cursing the ballet's bitter abandonment of every known tradition, The Rite went on to define its own tradition. In fact, within a few years of its premiere, The Rite was being performed to standing ovations and Stravinsky was being carried out of the auditorium on the shoulders of the crowd. Diaghilev joked, "Our little Igor now needs police escorts out of his concerts, like a prizefighter." The same symphony that once caused a violent riot became the cliched example of modern music. Audiences were able to hear its delicate patterns and found the frightening beauty buried in its undulations. By 1940, Walt Disney used The Rite in the sound track of Fantasia. The "Augurs" chord was fit for a cartoon.

The stubborn endurance of The Rite was its most subversive triumph. If Platonists believed that music had a natural definition, its order a reflection of some mathematical order outside of us, Stravinsky's symphony forced us to admit that music is our own creation. There is nothing holy about the symphony: it is simply some vibrating air that our brains have learned how to hear.

But how do we learn how to hear music? How does an oblivion of noise become a classic modern symphony? How does the pain of The Rite become pleasurable? The answer to these questions returns us to the brain's unique talent: its ability to change itself. The auditory cortex, like all our sensory areas, is deeply plastic. Neuroscience, stealing vocabulary from music, has named these malleable cells the corticofugal network, after the fugal form Bach made famous. These contrapuntal neurons feed back to the very substrate of hearing, altering the specific frequencies, amplitudes, and timing patterns that sensory cells actually respond to. The brain tunes its own sense of sound, just as violinists tune the strings of their instruments.

One of the central functions of the corticofugal network is what neuroscience calls egocentric selection. When a pattern of noises is heard repeatedly, the brain memorizes that pattern. Feedback from higher-up brain regions reorganizes the auditory cortex,
which makes it easier to hear the pattern in the future. This learning is largely the handiwork of dopamine, which modulates the cellular mechanisms underlying plasticity.

But what orders the corticofugal feedback? Who is in charge of our sensations? The answer is experience. While human nature largely determines how we hear the notes, it is nurture that lets us hear the music. From the three-minute pop song to the five-hour Wagner opera, the creations of our culture teach us to expect certain musical patterns, which over time are wired into our brain.

And once we learn these simple patterns, we become exquisitely sensitive to their variations. The brain is designed to learn by association: if this, then that. Music works by subtly toying with our expected associations, enticing us to make predictions and then confronting us with our prediction errors. In fact, the brainstem contains a network of neurons that responds only to surprising sounds. When the musical pattern we know is violated, these cells begin the neural process that ends with the release of dopamine, the same neurotransmitter that reorganizes the auditory cortex. (Dopamine is also the chemical source of our most intense emotions, which helps to explain the strange emotional power of music, especially when it confronts us with newness and dissonance.) By tempting us with fragile patterns, music taps into the most basic brain circuitry.

But dopamine has a dark side. When the dopamine system is imbalanced, the result is schizophrenia.* If dopamine neurons can't correlate their firing with outside events, the brain is unable to make cogent associations. Schizophrenics have elaborate auditory hallucinations precisely because their sensations do not match their mental predictions. As a result, they invent patterns where there are none and can't see the patterns that actually do exist.

The premiere of The Rite, with its methodical dismantling of the audience's musical expectations, literally simulated madness. By subverting the listeners' dopamine neurons, it also subverted their sanity. Everything about it felt wrong. Pierre Monteux, the conductor, said he was convinced that Stravinsky was a lunatic. During the symphony's lengthy rehearsals—it required twice as many sessions as The Firebird—the violinists denounced The Rite as "schmutzig" (dirty). Puccini said it was "the work of a madman." The brass musicians playing the massive fortissimos broke into spontaneous fits of laughter. Stravinsky took the long view. "Gentlemen, you do not have to laugh," he drolly told the rehearsing orchestra. "I know what I wrote."

With time, the musicians came to understand Stravinsky's method. His creativity was seared into their brains as their dopamine neurons adjusted to the "Augurs" chord. What once seemed like a void of noise became an expression of difficult magnificence. This is the corticofugal system at work. It takes a dissonant sound, a pattern we can't comprehend, and makes it comprehensible. As a result, the pain of The Rite becomes bearable. And then it becomes beautiful.
The corticofugal system has one very interesting side effect. Although it evolved to expand our minds—letting us learn an infinitude of new patterns—it can also limit our experiences. This is because the corticofugal system is a positive-feedback loop, a system whose output causes its input to recur. Think of the microphone placed too close to the speaker, so that the microphone amplifies its own sound. The resulting loop is a meaningless screech of white noise, the sound of uninterrupted positive feedback. Over time, the auditory cortex works the same way; we become better able to hear those sounds that we have heard before. This only encourages us to listen to the golden oldies we already know (since they sound better), and to ignore the difficult songs that we don't know (since they sound harsh and noisy, and release unpleasant amounts of dopamine). We are built to abhor the uncertainty of newness.

How do we escape this neurological trap? By paying attention to art. The artist is engaged in a perpetual struggle against the positive-feedback loop of the brain, desperate to create an experience that no one has ever had before. And while the poet must struggle to invent a new metaphor and the novelist a new story, the composer must discover the undiscovered pattern, for the originality is the source of the emotion. If the art feels difficult, it is only because our neurons are stretching to understand it. The pain flows from the growth. As Nietzsche sadistically declared, "If something is to stay in the memory it must be burned in; only that which never ceases to hurt stays in the memory."

This newness, however torturous, is necessary. Positive-feedback loops, like that shrieking microphone, always devour themselves. Without artists like Stravinsky who compulsively make everything new, our sense of sound would become increasingly narrow. Music would lose its essential uncertainty. Dopamine would cease to flow. As a result, the feeling would be slowly drained out of the notes, and all we would be left with would be a shell of easy consonance, the polite drivel of perfectly predictable music. Works like The Rite* jolt us out of this complacency. They keep us literally open-minded. If not for the difficulty of the avant-garde, we would worship nothing but that which we already know.

This is what Stravinsky knew: music is made by the mind, and the mind can learn to listen to almost anything. Given time, even the intransigent Rite would become just another musical classic, numbing listeners with its beauty. Its strange patterns would be memorized, and they would cease to hurt. The knifing chord of the "Augurs" would become dull with use, and all the meticulously engineered dissonances would fade into a tepid kind of pulchritude. This was Stravinsky's nightmare, and he knew it would come true.
What separated Stravinsky from his rioting audience that night was his belief in the limitless possibilities of the mind. Because our human brain can learn to listen to anything, music has no cage. All music needs is a violated pattern, an order interrupted by a disorder, for in that acoustic friction, we hallucinate a feeling. Music is that feeling. The Rite of Spring was the first symphonic work to celebrate this fact. It is the sound of art changing the brain.