THE LANGUAGE INSTINCT

ences. Some positive, and many negative. What misery, what des-
tion! The greatest number of human beings were killed in the two w-
wars of this century. But human nature is such that when we fa-
tremendous critical situation, the human mind can wake up and
some other alternative. That is a human capacity."

8

THE MEANING OF LIFE

Man does not live by bread alone, nor by know-how, safety, children, or sex. People everywhere spend as much time as they can afford on activities that, in the struggle to survive and reproduce, seem pointless. In all cultures, people tell stories and recite poetry. They joke, laugh, and tease. They sing and dance. They decorate surfaces. They perform rituals. They wonder about the causes of fortune and misfortune, and hold beliefs about the supernatural that contradict everything else they know about the world. They concoct theories of the universe and their place within it.

As if that weren't enough of a puzzle, the more biologically frivolous and vain the activity, the more people exalt it. Art, literature, music, wit, religion, and philosophy are thought to be not just pleasurable but noble. They are the mind's best work, what makes life worth living. Why do we pursue the trivial and futile and experience them as sublime? To many educated people the question seems horribly philistine, even immoral. But it is unavoidable for anyone interested in the biological makeup of *Homo sapiens*. Members of our species do mad deeds like taking vows of celibacy, living for their music, selling their blood to buy movie tickets, and going to graduate school. Why? How might we understand the psychology of the arts, humor, religion, and philosophy within the theme of this book, that the mind is a naturally selected neural computer?

Every college has a faculty of arts, which usually dominates the institution in numbers and in the public eye. But the tens of thousands of scholars and millions of pages of scholarship have shed almost no light

on the question of why people pursue the arts at all. The function of the arts is almost defiantly obscure, and I think there are several reasons why.

One is that the arts engage not only the psychology of aesthetics but the psychology of status. The very uselessness of art that makes it incomprehensible to evolutionary biology makes it all too comprehensible to economics and social psychology. What better proof that you have money to spare than your being able to spend it on doodads and stuff that don't fill the belly or keep the rain out but that require precious materials, years of practice, a command of obscure texts, or intimacy with the elite? Thorstein Veblen's and Quentin Bell's analyses of taste and fashion, in which an elite's conspicuous displays of consumption, leisure, and outrage are emulated by the rabble, sending the elite off in search of new inimitable displays, nicely explain the otherwise inexplicable oddities of the arts. The grand styles of one century become tacky in the next, as we see in words that are both period labels and terms of abuse (*gothic, mannerist, baroque, rococo*). The steadfast patrons of the arts are the aristocracy and those who want to join them. Most people would lose their taste for a musical recording if they learned it was being sold at supermarket checkout counters or on late-night television, and even the work of relatively prestigious artists, such as Pierre Auguste Renoir, draws derisive reviews when it is shown in a popular "blockbuster" museum show. The value of art is largely unrelated to aesthetics: a priceless masterpiece becomes worthless if it is found to be a forgery, soup cans and comic strips become high art when the art world says they are, and then command conspicuously wasteful prices. Modernist and postmodern works are intended not to give pleasure but to confuse and confound the theories of a guild of critics and analysts, to *épater la bourgeoisie*, or to baffle the rubes in Peoria.

The banality that the psychology of the arts is partly the psychology of status has been repeatedly pointed out, not just by cynics and barbarians but by erudite social commentators such as Quentin Bell and Tom Wolfe. But in the modern university, it is unmentioned, indeed, unmentionable. Academics and intellectuals are culture vultures. In a gathering of today's elite, it is perfectly acceptable to laugh that you barely passed Physics for Poets and Rocks for Jocks and have remained ignorant of science ever since, despite the obvious importance of scientific literacy to informed choices about personal health and public policy. But say that you have never heard of James Joyce or that you tried listening

art once but prefer Andrew Lloyd Webber is as shocking as blowing your nose on your sleeve or announcing that you employ children in your sweatshop, despite the obvious *un*importance of your tastes in leisure-time activity to just about anything. The blending in people's minds of taste, status, and virtue is an extension of Bell's principle of sartorial morality that we met in Chapter 7: people find dignity in the signs of an honorably futile existence removed from all menial necessities.

I mention these facts not to denigrate the arts but to clarify my topic. I want you to look at the psychology of the arts (and later, humor and religion) with the disinterested eye of an alien biologist trying to make sense of the human species rather than as a member of the species with a stake in how the arts are portrayed. *Of course* we find pleasure and enlightenment in contemplating the products of the arts, and not all of it is pride in sharing the tastes of the beautiful people. But to understand the psychology of the arts that remains when we subtract out the psychology of status, we must leave at the door our terror of being mistaken for the kind of person who prefers Andrew Lloyd Webber to Mozart. We need to begin with folk songs, pulp fiction, and paintings on black velvet, not Mahler, Eliot, and Kandinsky. And that does *not* mean compensating for our slumming by dressing up the lowly subject matter in highfalutin theory" (a semiotic analysis of *Peanuts*, a psychoanalytic exegesis of Archie Bunker, a deconstruction of *Vogue*). It means asking a simple question: What is it about the mind that lets people take pleasure in shapes and colors and sounds and jokes and stories and myths?

That question might be answerable, whereas questions about art in general are not. Theories of art carry the seeds of their own destruction. In an age when any Joe can buy CDs, paintings, and novels, artists make their careers by finding ways to avoid the hackneyed, to challenge jaded critics, to differentiate the cognoscenti from the dilettantes, and to flout the current wisdom about what art is (hence the fruitless attempts over the decades to define art). Any discussion that fails to recognize that dynamic is doomed to sterility. It can never explain why music pleases the ear, because "music" will be defined to encompass atonal jazz, chromatic compositions, and other intellectual exercises. It will never understand the bawdy laughs and convivial banter that are so important in people's lives because it will define humor as the arch wit of an Oscar Wilde. Excellence and the avant-garde are designed for the sophisticated elite, a product of years of immersion in a genre and a familiarity with its conventions and clichés. They rely on one-upmanship and arcane

allusions and displays of virtuosity. However fascinating and worthy of our support they are, they tend to obscure the psychology of aesthetics not to illuminate it.

Another reason the psychology of the arts is obscure is that they aren't adaptive in the biologist's sense of the word. This book has been about the adaptive design of the major components of the mind, but that does not mean that I believe that everything the mind does is biologically adaptive. The mind is a neural computer, fitted by natural selection with combinatorial algorithms for causal and probabilistic reasoning about plants, animals, objects, and people. It is driven by goal states that serve biological fitness in ancestral environments, such as food, sex, safety, parenthood, friendship, status, and knowledge. That toolbox, however, can be used to assemble Sunday afternoon projects of dubious adaptive value.

Some parts of the mind register the attainment of increments of fitness by giving us a sensation of pleasure. Other parts use a knowledge of cause and effect to bring about goals. Put them together and you get a mind that rises to a biologically pointless challenge: figuring out how to get at the pleasure circuits of the brain and deliver little jolts of enjoyment without the inconvenience of wringing bona fide fitness increments from the harsh world. When a rat has access to a lever that sends electrical impulses to an electrode implanted in its medial forebrain bundle, it presses the lever furiously until it drops of exhaustion, forgoing opportunities to eat, drink, and have sex. People don't yet undergo elective neurosurgery to have electrodes implanted in their pleasure centers, but they have found ways to stimulate them by other means. An obvious example is recreational drugs, which seep into the chemical junctions of the pleasure circuits.

Another route to the pleasure circuits is via the senses, which stimulate the circuits when they are in environments that would have led to fitness in past generations. Of course a fitness-promoting environment cannot announce itself directly. It gives off patterns of sounds, sights, smells, tastes, and feels that the senses are designed to register. Now if the intellectual faculties could identify the pleasure-giving patterns, purify them, and concentrate them, the brain could stimulate itself with

the messiness of electrodes or drugs. It could give itself intense artificial doses of the sights and sounds and smells that ordinarily are given off by healthful environments. We enjoy strawberry cheesecake, but not because we evolved a taste for it. We evolved circuits that gave us trickles of enjoyment from the sweet taste of ripe fruit, the creamy mouth feel of fats and oils from nuts and meat, and the coolness of fresh water. Cheesecake packs a sensual wallop unlike anything in the natural world because it is a brew of megadoses of agreeable stimuli which we concocted for the express purpose of pressing our pleasure buttons. Pornography is another pleasure technology. In this chapter I will suggest that the arts are a third.

There is another way that the design of the mind can throw off fascinating but biologically functionless activities. The intellect evolved to crack the defenses of things in the natural and social world. It is made up of modules for reasoning about how objects, artifacts, living things, animals, and other human minds work (Chapter 5). There are problems in the universe other than those: where the universe came from, how physical flesh can give rise to sentient minds, why bad things happen to good people, what happens to our thoughts and feelings when we die. The mind can pose such questions but may not be equipped to answer them, even if the questions have answers. Given that the mind is a product of natural selection, it should not have a miraculous ability to commune with all truths; it should have a mere ability to solve problems that are sufficiently similar to the mundane survival challenges of our ancestors. According to a saying, if you give a boy a hammer, the whole world becomes a nail. If you give a species an elementary grasp of mechanics, biology, and psychology, the whole world becomes a machine, a jungle, and a society. I will suggest that religion and philosophy are in part the application of mental tools to problems they were not designed to solve.

Some readers may be surprised to learn that after seven chapters of reverse-engineering the major parts of the mind, I will conclude by arguing that some of the activities we consider most profound are nonadaptive by-products. But both kinds of argument come from a single standard, the criteria for biological adaptation. For the same reason that it is wrong to write off language, stereo vision, and the emotions as evolutionary accidents—namely, their universal, complex, reliably developing, well-engineered, reproduction-promoting design—it is wrong to invent functions for activities that lack that design merely because we want to

writers have said that the "function" of the arts is to bring the commu
together, to help us see the world in new ways, to give us a sense of h
mony with the cosmos, to allow us to experience the sublime, and so
All these claims are true, but none is about adaptation in the techni
sense that has organized this book: a mechanism that brings about
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building that mechanism in the environment in which we evolved. So
aspects of the arts, I think, do have functions in this sense, but mos
not.

ARTS AND ENTERTAINMENT

The visual arts are a perfect example of a technology designed to de
the locks that safeguard our pleasure buttons and to press the buttons
various combinations. Recall that vision solves the unsolvable problem
recovering a description of the world from its projection onto the ret
by making assumptions about how the world is put together, such
smooth matte shading, cohesive surfaces, and no razor-edge alignme
Optical illusions—not just cereal-box material but the ones that
Leonardo's window, such as paintings, photographs, movies, and tele
sion—cunningly violate those assumptions and give off patterns of li
that dupe our visual system into seeing scenes that aren't there. That
the lock-picking. The pleasure buttons are the content of the illusion
Everyday photographs and paintings (remember—think "motel room
not "Museum of Modern Art") depict plants, animals, landscapes, a
people. In previous chapters we saw how the geometry of beauty is
visible signal of adaptively valuable objects: safe, food-rich, explorable
learnable habitats, and fertile, healthy dates, mates, and babies.

Less obvious is why we take pleasure in abstract art: the zigzag
plaids, tweeds, polka dots, parallels, circles, squares, stars, spirals, and
splashes of color with which people decorate their possessions and bo
ies all over the world. It cannot be a coincidence that exactly these kind
of motifs have been posited by vision researchers as the features of the
world that our perceptual analyzers lock onto as they try to make sense of
the surfaces and objects out there (see Chapter 4). Straight lines, para
lel lines, smooth curves, and right angles are some of the nonaccidental
properties that the visual system seeks out because they are giveaways

arts of the world that contain solid objects or that have been shaped by
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ed with repetitions of a pattern usually comes from a single surface in
e world, like a tree trunk, a field, a rock face, or a body of water. A hard
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g another. Bilateral symmetry almost always comes from animals, parts
plants, or human artifacts.

Other patterns that we find pretty help us to recognize objects by
eir three-dimensional shapes. Frames of reference are fitted onto
ounded, elongated shapes, onto symmetrical shapes, and onto shapes
ch parallel or near-parallel edges. Once fitted, the shapes are mentally
ived into geons (cones, cubes, and cylinders) before being matched
gainst memory.

All of the optimal geometric features for visual analysis that I have
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w do we explain the overlap? Why is the optimal feedstock for visual
ocessing pretty to look at?

First, we seem to get pleasure out of looking at purified, concentrated
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icrosatisfaction as we orient ourselves toward informative environ-
ents and fine-tune our vision to give us a clear picture of them. Think
the annoyance you feel when a movie is out of focus and your relief
en the projectionist wakes up and twiddles the lens. The fuzzy picture
sembles your own retinal image when you are not properly accommo-
ting the lens of your eye. The dissatisfaction is the impetus to accom-
odate; the satisfaction tells you when you have succeeded. Bright,
sp, saturated, contrasty images, whether from an expensive television
or from a colorful painting, may exaggerate the click of pleasure we
when we have adjusted our eyes properly.

And it is frustrating, even frightening, to gaze at a scene in poor view-
g conditions—far away, at night, or through haze, water, or foliage—
d be unable to make head or tail of it, not knowing, for example,
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d another begins. A canvas that is cleanly divided into solid shapes and
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Finally, we find some parts of the world snazzy and other parts dreary
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Finally, we find some parts of the world snazzy and other parts dreary
the extent that they convey information about improbable, informa

tion-rich, consequential objects and forces. Imagine scooping out
entire scene in front of you, putting it in a giant blender set on LIQUI
and pouring the detritus back in front of you. The scene no longer
tains any object of interest. Any food, predators, shelter, hiding pla
vantage points, tools, and raw materials have been ground into slu
And what does it look like? It has no lines, no shapes, no symmetry
no repetition. It is brown, just like the color you got when you mixed
your paints together as a child. It has nothing to look at because it
nothing in it. The thought experiment shows that drabness comes
an environment with nothing to offer, and its opposite, visual pizz
comes from an environment that contains objects worth paying atten
to. Thus we are designed to be dissatisfied by bleak, featureless sce
and attracted to colorful, patterned ones. We push that pleasure bu
with vivid artificial colors and patterns.

Music is an enigma. In *Much Ado About Nothing*, Benedick asks,
not strange that sheep's guts should hale souls out of men's bodies
all cultures, certain rhythmic sounds give listeners intense pleasure
heartfelt emotions. What benefit could there be to diverting time
energy to the making of plinking noises, or to feeling sad when no
has died? Many suggestions have been made—music bonds the so
group, coordinates action, enhances ritual, releases tension—but
just pass the enigma along rather than explaining it. *Why* do rhyth
sounds bond the group, dissipate tension, and so on? As far as biolo
cause and effect are concerned, music is useless. It shows no sign
design for attaining a goal such as long life, grandchildren, or accu
perception and prediction of the world. Compared with language, visio
social reasoning, and physical know-how, music could vanish from
species and the rest of our lifestyle would be virtually unchanged. Mu
appears to be a pure pleasure technology, a cocktail of recreational dr
that we ingest through the ear to stimulate a mass of pleasure circuits
once.

"Music is the universal language," says the cliché, but that is misle
ing. Anyone who lived through the craze for Indian raga music a
George Harrison made it hip in the 1960s appreciates that musical s
vary from culture to culture and that people most enjoy the idiom

grew up with. (During the Concert for Bangladesh, Harrison was morti-
fied when the audience applauded Ravi Shankar for tuning up his sitar.)
Musical sophistication also varies across people, cultures, and historical
periods in ways that language does not. All neurologically normal chil-
dren spontaneously speak and understand complex language, and the
complexity of spoken vernaculars varies little across cultures and peri-
ods. In contrast, while everyone enjoys listening to music, many people
cannot carry a tune, fewer can play an instrument, and those who can
have need explicit training and extensive practice. Musical idioms vary
greatly in complexity across time, cultures, and subcultures. And music
communicates nothing but formless emotion. Even a plot as simple as
"boy meets girl, boy loses girl" cannot be narrated by a sequence of tones
in any musical idiom. All this suggests that music is quite different from
language and that it is a technology, not an adaptation.

But there are *some* parallels. As we shall see, music may borrow some
of the mental software for language. And just as the world's languages
conform to an abstract Universal Grammar, the world's musical idioms
conform to an abstract Universal Musical Grammar. That idea was first
broached by the composer and conductor Leonard Bernstein in *The
Unanswered Question*, a passionate attempt to apply Noam Chomsky's
ideas to music. The richest theory of universal musical grammar has
been worked out by Ray Jackendoff in collaboration with the music theo-
rist Fred Lerdahl and incorporating the ideas of many musicologists
before them, most prominently Heinrich Schenker. According to the the-
ory, music is built from an inventory of notes and a set of rules. The rules
assemble notes into a sequence and organize them into three hierarchi-
cal structures, all superimposed on the same string of notes. To under-
stand a musical piece means to assemble these mental structures as we
listen to the piece.

The building blocks of a musical idiom are its inventory of notes—
roughly, the different sounds that a musical instrument is designed to
emit. The notes are played and heard as discrete events with beginnings
and ends and a target pitch or coloring. That sets music apart from most
other streams of sound, which slide continuously up or down, such as a
howling wind, an engine roar, or the intonation of speech. The notes dif-
fer in how *stable* they feel to a listener. Some give a feeling of finality or
restedness, and are suitable endings of a composition. Others feel
unstable, and when they are played the listener feels a tension that is
resolved when the piece returns to a more stable note. In some musical

idioms, the notes are drumbeats with different timbres (coloring or qu
ity). In others, the notes are pitches that are arrayed from high to low b
not placed at precise intervals. But in many idioms the notes are tones
a fixed pitch; we label ours "do, re, mi, . . ." or "C, D, E, . . ." The musi
significance of a pitch cannot be defined in absolute terms, but only
an interval between it and a reference pitch, usually the stablest one
the set.

The human sense of pitch is determined by the frequency of vibrat
of the sound. In most forms of tonal music, the notes in the inventory
related to the frequencies of vibration in a straightforward way. When
object is set into a sustained vibration (a string is plucked, a holl
object is struck, a column of air reverberates), the object vibrates at se
eral frequencies at once. The lowest and often loudest frequency—th
fundamental—generally determines the pitch we hear, but the obje
also vibrates at twice the fundamental frequency (but typically not
intensely), at three times the frequency (even less intensely), at fo
times (less intensely still), and so on. These vibrations are called ha
monics or overtones. They are not perceived as pitches distinct from th
fundamental, but when they are all heard together they give a note
richness or timbre.

But now imagine disassembling a complex tone and playing each o
its overtones separately and at the same volume. Say the fundamen
frequency is 64 vibrations a second, the second C below middle C on th
piano. The first overtone is a vibration at 128 cycles a second, tw
the frequency of the fundamental. Played by itself, it sounds higher than th
fundamental but with the same pitch; on the piano, it corresponds
the next C going up the keyboard, the C below middle C. The inter
between the two notes is called an octave, and all people—indeed a
mammals—perceive tones separated by an octave as having the sam
quality of pitch. The second overtone vibrates at three times the fund
mental frequency, 192 times per second, and corresponds to G belo
middle C; the interval between the pitches is called the perfect fifth
The third overtone, four times the fundamental (256 vibrations per se
ond), is two octaves above it, middle C. The fourth overtone, five tim
the fundamental (320 vibrations a second), is the E above middle C, se
arated from it by an interval called the major third.

These three pitches are the heart of the pitch inventory in Weste
music and many other idioms. The lowest and most stable note, C in ou
example, is called the tonic, and most melodies tend to return to it and

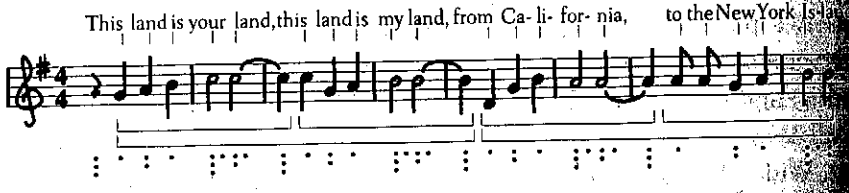
nd on it, giving the listener a sense of repose. The perfect fifth or G note
scalled the dominant, and melodies tend to move toward it and pause
here at intermediate points in the melody. The major third or E note, in
many (but not all) cases, gives a feeling of brightness, pleasantness, or joy.
or example, the opening of Bill Haley's "Rock Around the Clock" begins
with the tonic ("One o'clock, two o'clock, three o'clock, rock") proceeds
the major third ("Four o'clock, five o'clock, six o'clock, rock"), goes to
he dominant ("Seven o'clock, eight o'clock, nine o'clock, rock") and remains
here for several beats before launching into the main verses, each of
hich ends on the tonic.

More complicated pitch inventories are filled out by adding notes to
he tonic and the dominant, often corresponding in pitch to the higher
nd higher (and softer and softer) overtones of a complex vibration. The
seventh overtone of our reference note (448 vibrations a second) is close
middle A (but, for complicated reasons, not exactly at it). The ninth
576 vibrations a second) is the D in the octave above middle C. Put the
ve pitches together in the same octave and you get the five-tone or pen-
tonic scale, common in musical systems across the world. (At least,
his is a popular explanation of where musical scales come from; not
veryone agrees.) Add the pitches of the next two distinct overtones (F
nd B) and you get the seven-tone or diatonic scale that forms the core
f all Western music, from Mozart to folk songs to punk rock to most
azz. With additional overtones you get the chromatic scale, all the white
nd black keys on the piano. Even the esoteric art music of the twentieth
entury, incomprehensible to the uninitiated, tends to stick to the notes
the chromatic scale rather than using arbitrary collections of frequen-
ies. Added to the feeling that most notes "want" to return to the tonic
C) are other tensions among the notes. For example, in many musical
ontexts B wants to go up to C, F wants to be pulled toward E, and A
ants to go to G.

Pitch inventories may also contain notes that add an emotional color-
ng. In the C major scale, if the E is lowered in pitch by half a tone to E-
at, forming an interval with respect to C called the minor third, then in
omparison with its major counterpart it tends to evoke a feeling of sad-
ess, pain, or pathos. The minor seventh is another "blue note," which
vokes a gentle melancholy or mournfulness. Other intervals give off
eelings that have been described as stoic, yearning, needful, dignified,
issonant, triumphant, horrific, flawed, and determined. The feelings are
voked both when the notes are played in succession as part of a melody

and when they are played simultaneously as part of a chord or harmon
The emotional connotations of musical intervals are not exactly univer
sal, because people need to be familiar with an idiom to experience
them, but they are not arbitrary either. Infants as young as four month
old prefer music with consonant intervals such as a major third to musi
with dissonant intervals such as a minor second. And to learn the more
complex emotional colorings of music, people do not have to be condi
tioned Pavlov-style, say, by hearing intervals paired with joyful or melan
choly lyrics or by hearing them while in a joyful or a melancholy mood.
person merely has to listen to melodies in a particular idiom over time
absorbing the patterns and contrasts among the intervals, and the emo
tional connotations develop automatically.

Those are the pitches; how are they strung into melodies? Jackendoff
and Lerdahl show how melodies are formed by sequences of pitches that
are organized in three different ways, all at the same time. Each pattern
of organization is captured in a mental representation. Take the opening
of Woody Guthrie's "This Land Is Your Land":

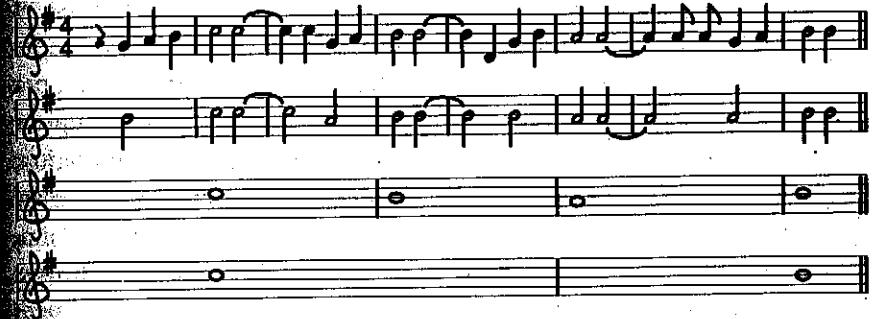


The first representation is called a grouping structure. The listener
feels that groups of notes hang together in motifs, which in turn are
grouped into phrases, which are grouped into lines or sections, which are
grouped into stanzas, movements, and pieces. This hierarchical tree is
similar to the phrase structure of a sentence, and when the music has
lyrics, the two partly line up. The grouping structure is shown here by
the brackets beneath the music. The snatches of melody for "This land is
your land" and for "this land is my land" are the smallest-sized chunks.
When they are joined together, they form a larger chunk. That larger
chunk is joined with the combined chunk "from California to the New
York Island" into a still larger chunk, and so on.

The second representation is a metrical structure, the repeating
sequence of strong and weak beats that we count off as "ONE-two-
THREE-four, ONE-two-THREE-four." The overall pattern is summed up in
musical notation as the time signature, such as 4/4, and the individual
boundaries of the structure itself are demarcated by the vertical lines

separating the music into bars. Each bar contains four beats, allocated among the different notes, with the first beat getting the strongest emphasis, the third beat an intermediate emphasis, and the second and fourth beats remaining weak. The metrical structure in this example is illustrated by the columns of dots under the notes. Each column corresponds to one tick of a metronome. The more dots in a column, the stronger the accent on that note.

The third representation is a reductional structure. It dissects the melody into essential parts and ornaments. The ornaments are stripped off and the essential parts further dissected into even *more* essential parts and ornaments on them. The reduction continues until the melody is reduced to a bare skeleton of a few prominent notes. Here is "This Land" boiled down first to half tones, then to four whole tones, then to only two whole tones.



The whole passage is basically a fancy way of getting from C to B. We hear the reductional structure of a melody in the chords of the rhythm guitar line. We also hear it when the band accompanying a tap dancer plays one of the stanzas in stop time, striking a single note in place of an entire line of music so that the tapping is easier to hear. And we sense it when we recognize variations of a piece in classical music or jazz. The skeleton of the melody is conserved while the ornaments differ from variation to variation.

Jackendoff and Lerdahl propose that there are in fact *two* ways that melodies may be dissected into simpler and simpler skeletons. I have shown you the first way, the time-span reduction, which lines up with the grouping and metrical structures and designates some of the groups and beats as ornaments on others. Jackendoff and Lerdahl call the second one a prolongation reduction. It captures the sense of musical flow across phrases, the buildup and release of tension within longer and longer passages over the course of the piece, culminating in a feeling of

maximum repose at the end. Tension builds up as the melody departs from the more stable notes to the less stable notes, and is discharged when the melody returns to the stable ones. The contours of tension and release are also defined by changes from dissonant to consonant chords, from nonaccented to accented notes, from higher to lower notes, and from prolonged to nonprolonged notes.

The musicologist Deryck Cooke worked out a theory of the emotional semantics of the prolongation reduction. He showed how music conveys tension and resolution by transitions across unstable and stable intervals, and conveys joy and sorrow by transitions across major and minor intervals. Simple motifs of only four or five notes, he said, convey feelings like "innocent, blessed joy," "demonic horror," "continuous pleasurable longing," and "a burst of anguish." Longer stretches, and passages with motifs within motifs, can convey intricate patterns of feeling. One passage, as Cooke analyzes it, expresses "the feeling of a passionate outburst of painful emotion, which does not protest further, but falls back into acceptance—a flow and ebb of grief. Being neither complete protest nor complete acceptance, it has an effect of restless sorrow." Cooke supports his analyses with lists of examples that have a consensus interpretation, many with lyrics that offer additional corroboration. Some musicologists scoff at theories like Cooke's, finding counterexamples to every claim. But the exceptions tend to come from fine classical music, which uses interleaved, embedded, and ambiguous lines to challenge simple expectations and engage a sophisticated listener. Cooke's particular analyses may be debatable, but his main idea that there are lawful connections between patterns of intervals and patterns of emotion is clearly on the right track.

So that is the basic design of music. But if music confers no survival advantage, where does it come from and why does it work? I suspect that music is auditory cheesecake, an exquisite confection crafted to tickle the sensitive spots of at least six of our mental faculties. A standard piece tickles them all at once, but we can see the ingredients in various kinds of not-quite-music that leave one or more of them out.

1. Language. We can put words to music, and we wince when a lazy lyricist aligns an accented syllable with an unaccented note or vice versa.

That suggests that music borrows some of its mental machinery from language—in particular, from prosody, the contours of sound that span many syllables. The metrical structure of strong and weak beats, the intonation contour of rising and falling pitch, and the hierarchical grouping of phrases within phrases all work in similar ways in language and in music. The parallel may account for the gut feeling that a musical piece conveys a complex message, that it makes assertions by introducing topics and commenting on them, and that it emphasizes some portions and whispers others as asides. Music has been called "heightened speech," and it can literally grade into speech. Some singers slip into "talking on pitch" instead of carrying the melody, like Bob Dylan, Lou Reed, and Rex Harrison in *My Fair Lady*. They sound halfway between animated raconteurs and tone-deaf singers. Rap music, ringing oratory from preachers, and poetry are other intermediate forms.

2. Auditory scene analysis. Just as the eye receives a jumbled mosaic of patches and must segregate surfaces from their backdrops, the ear receives a jumbled cacophony of frequencies and must segregate the streams of sound that come from different sources—the soloist in an orchestra, a voice in a noisy room, an animal call in a chirpy forest, a howling wind among rustling leaves. Auditory perception is inverse acoustics: the input is a sound wave, the output a specification of the soundmakers in the world that gave rise to it. The psychologist Albert Bregman has worked out the principles of auditory scene analysis and has shown how the brain strings together the notes of a melody as if it were a stream of sound coming from a single soundmaker.

One of the brain's tricks as it identifies the soundmakers in the world is to pay attention to harmonic relations. The inner ear dissects a blare into its component frequencies, and the brain glues some of the components back together and perceives them as a complex tone. Components that stand in harmonic relations—a component at one frequency, another component at twice that frequency, yet another component at three times the frequency, and so on—are grouped together and perceived as a single tone rather than as separate tones. Presumably the brain glues them together to make our perception of sound reflect reality. Simultaneous sounds in harmonic relations, the brain guesses, are probably the overtones of a single sound coming from one soundmaker in the world. That is a good guess because many resonators, such as plucked strings, struck hollow bodies, and calling animals, emit sounds composed of many harmonic overtones.

What does this have to do with melody? Tonal melodies are sometimes said to be "serialized overtones." Building a melody is like slicing a complex harmonic sound into its overtones and laying them end to end in a particular order. Perhaps melodies are pleasing to the ear for the same reason that symmetrical, regular, parallel, repetitive doodles are pleasing to the eye. They exaggerate the experience of being in an environment that contains strong, clear, analyzable signals from interesting, potent objects. A visual environment that cannot be seen clearly or that is composed of homogeneous sludge looks like a featureless sea of brown or gray. An auditory environment that cannot be heard clearly or that is composed of homogeneous noise sounds like a featureless stream of radio static. When we hear harmonically related tones, our auditory system is satisfied that it has successfully carved the auditory world into parts that belong to important objects in the world, namely, resonating soundmakers like people, animals, and hollow objects.

Continuing this line of thought, we might observe that the more stable notes in a scale correspond to the lower and typically louder overtones emanating from a single soundmaker, and can confidently be grouped with the soundmaker's fundamental frequency, the reference note. The less stable notes correspond to the higher and typically weaker overtones, and though they *may* have come from the same soundmaker as the reference note, the assignment is less secure. Similarly, notes separated by a major interval are sure to have come from a single resonator, but notes separated by a minor interval might be very high overtones (and hence weak and uncertain ones), *or* they might come from a soundmaker with a complicated shape and material that does not give out a nice clear tone, *or* they might not come from a single soundmaker at all. Perhaps the ambiguity of the source of a minor interval gives the auditory system a sense of unsettledness that is translated as sadness elsewhere in the brain. Wind chimes, church bells, train whistles, claxton horns, and warbling sirens can evoke an emotional response with just two harmonically related tones. Recall that a few jumps among tones are the heart of a melody; all the rest is layer upon layer of ornamentation.

3. Emotional calls. Darwin noticed that the calls of many birds and primates are composed of discrete notes in harmonic relations. He speculated that they evolved because they were easy to reproduce time after time. (Had he lived a century later, he would have said that digital representations are more repeatable than analog ones.) He suggested, not too plausibly, that human music grew out of our ancestors' mating calls. But

his suggestion may make sense if it is broadened to include all emotional calls. Whimpering, whining, crying, weeping, moaning, growling, cooing, laughing, yelping, baying, cheering, and other ejaculations have acoustic signatures. Perhaps melodies evoke strong emotions because their skeletons resemble digitized templates of our species' emotional calls. When people try to describe passages of music in words, they use these emotional calls as metaphors. Soul musicians mix their singing with growls, cries, moans, and whimpers, and singers of torch songs and country-and-western music use catches, cracks, hesitations, and other emotional tics. Ersatz emotion is a common goal of art and recreation; I will discuss the reasons in a following section.

4. Habitat selection. We pay attention to features of the visual world that signal safe, unsafe, or changing habitats, such as distant views, greenery, gathering clouds, and sunsets (see Chapter 6). Perhaps we also pay attention to features of the auditory world that signal safe, unsafe, or changing habitats. Thunder, wind, rushing water, birdsong, growls, footsteps, heartbeats, and snapping twigs all have emotional effects, presumably because they are thrown off by attention-worthy events in the world. Perhaps some of the stripped-down figures and rhythms at the heart of a melody are simplified templates of evocative environmental sounds. In the device called tone painting, composers intentionally try to evoke environmental sounds like thunder or birdsong in a melody.

Perhaps a pure example of the emotional tug of music may be found in cinematic soundtracks. Many movies and television shows literally orchestrate the viewers' emotions from beginning to end with quasi-musical arrangements. They have no real rhythm, melody, or grouping, but can yank the moviegoer from feeling to feeling: the climactic rising scales of silent films, the lugubrious strings in the mushy scenes of old black-and-white movies (the source of the sarcastic violin-bowing gesture that means "You are trying to manipulate my sympathy"), the ominous two-note motif from *Jaws*, the suspenseful cymbal and drumbeats in the *Mission Impossible* television series, the furious cacophony during fights and chase scenes. It's not clear whether this pseudo-music distills the contours of environmental sounds, speech, emotional cries, or some combination, but it is undeniably effective.

5. Motor control. Rhythm is the universal component of music, and in many idioms it is the primary or only component. People dance, nod, shake, swing, stride, clap, and snap to music, and that is a strong hint that music taps into the system of motor control. Repetitive actions like

walking, running, chopping, scraping, and digging have an optimal rhythm (usually an optimal pattern of rhythms within rhythms), which is determined by the impedances of the body and of the tools or surfaces one is working with. A good example is pushing a child on a swing. A constant rhythmic pattern is an optimal way to time these motions, and we get moderate pleasure from being able to stick to it, which athletes call getting in a groove or feeling the flow. Music and dance may be a concentrated dose of that stimulus to pleasure. Muscle control also embraces sequences of tension and release (for example, in leaping or striking), actions carried out with urgency, enthusiasm, or lassitude, and erect or slumping body postures that reflect confidence, submission, or depression. Several psychologically oriented music theorists, including Jackendoff, Manfred Clynes, and David Epstein, believe that music recreates the motivational and emotional components of movement.

6. Something else. Something that explains how the whole is more than the sum of the parts. Something that explains why watching a slide go in and out of focus or dragging a filing cabinet up a flight of stairs does not hale souls out of men's bodies. Perhaps a resonance in the brain between neurons firing in synchrony with a soundwave and a natural oscillation in the emotion circuits? An unused counterpart in the right hemisphere of the speech areas in the left? Some kind of spandrel or crawl space or short-circuit or coupling that came along as an accident of the way that auditory, emotional, language, and motor circuits are packed together in the brain?

This analysis of music is speculative, but it nicely complements the discussions of the mental faculties in the rest of the book. I chose them as topics because they show the clearest signs of being adaptations. I chose music because it shows the clearest signs of not being one.

"The fact is I am quite happy in a movie, even a bad movie. Other people, so I have read, treasure memorable moments in their lives." At least the narrator of Walker Percy's novel *The Moviegoer* acknowledges the difference. Television stations get mail from soap-opera viewers with death threats for the evil characters, advice to the lovelorn ones, and booties for the babies. Mexican moviegoers have been known to riddle the screen with bullets. Actors complain that fans confuse them with their

roles; Leonard Nimoy wrote a memoir called *I Am Not Spock*, then gave up and wrote another one called *I Am Spock*. These anecdotes appear regularly in the newspapers, usually to insinuate that people today are boobs who cannot distinguish fantasy from reality. I suspect that the people are not literally deluded but are going to extremes to enhance the pleasure we all get from losing ourselves in fiction. Where does this motive, found in all peoples, come from?

Horace wrote that the purpose of literature is "to delight and instruct," a function echoed centuries later by John Dryden when he defined a play as "a just and lively image of human nature, representing its passions and humours, and the changes of fortune to which it is subject; for the delight and instruction of mankind." It's helpful to distinguish the delight, perhaps the product of a useless technology for pressing our pleasure buttons, from the instruction, perhaps a product of a cognitive adaptation.

The technology of fiction delivers a simulation of life that an audience can enter in the comfort of their cave, couch, or theater seat. Words can evoke mental images, which can activate the parts of the brain that register the world when we actually perceive it. Other technologies violate the assumptions of our perceptual apparatus and trick us with illusions that partly duplicate the experience of seeing and hearing real events. They include costumes, makeup, sets, sound effects, cinematography, and animation. Perhaps in the near future we can add virtual reality to the list, and in the more distant future the feelies of *Brave New World*.

When the illusions work, there is no mystery to the question "Why do people enjoy fiction?" It is identical to the question "Why do people enjoy life?" When we are absorbed in a book or a movie, we get to see breathtaking landscapes, hobnob with important people, fall in love with ravishing men and women, protect loved ones, attain impossible goals, and defeat wicked enemies. Not a bad deal for seven dollars and fifty cents!

Of course, not all stories have happy endings. Why would we pay seven dollars and fifty cents for a simulation of life that makes us miserable? Sometimes, as with art films, it is to gain status through cultural machismo. We endure a pummeling of the emotions to differentiate ourselves from the crass philistines who actually go to the movies to enjoy themselves. Sometimes it is the price we pay to satisfy two incompatible desires: stories with happy endings and stories with unpredictable end-

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ings, which preserve the illusion of a real world. There have to be some stories in which the murderer does catch up with the heroine in the basement, or we would never feel suspense and relief in the stories in which she escapes. The economist Steven Landsburg observes that happy endings predominate when no director is willing to sacrifice the popularity of his or her film for the greater good of more suspense in the movies in general.

But then how can we explain the tearjerker, aimed at a market of moviegoers who *enjoy* being defrauded into grief? The psychologist Paul Rozin lumps tearjerkers with other examples of benign masochism like smoking, riding on roller coasters, eating hot chili peppers, and sitting in saunas. Benign masochism, recall, is like the drive of Tom Wolfe's test pilots to push the outside of the envelope. It expands the range of options in life by testing, in small increments, how closely one can approach a brink of disaster without falling over it. Of course the theory would be vacuous if it offered a glib explanation for every inexplicable act, and it would be false if it predicted that people would pay to have needles stuck under their fingernails. But the idea is more subtle. Benign masochists must be confident that no serious harm will befall them. They must bring on the pain or fear in measured increments. And they must have an opportunity to control and mitigate the damage. The technology of tearjerkers seems to fit. Moviegoers know the whole time that when they leave the theater they will find their loved ones unharmed. The heroine is done in by a progressive disease, not a heart attack or a piece of hot dog stuck in the throat, so we can prepare our emotions for the tragedy. We only have to accept the abstract premise that the heroine will die; we are excused from witnessing the disagreeable details. (Greta Garbo, Ali MacGraw, and Debra Winger all looked quite lovely as they wasted away from consumption and cancer.) And the viewer must identify with the next of kin, empathize with their struggle to cope, and feel confident that life will go on. Tearjerkers simulate a triumph over tragedy.

Even following the foibles of ordinary virtual people as they live their lives can press a pleasure button, the one labeled "gossip." Gossip is a favorite pastime in all human societies because knowledge is power. Knowing who needs a favor and who is in a position to offer one, who is trustworthy and who is a liar, who is available (or soon to become available) and who is under the protection of a jealous spouse or family—all give obvious strategic advantages in the games of life. That is especially

true when the information is not yet widely known and one can be the first to exploit an opportunity, the social equivalent of insider trading. In the small bands in which our minds evolved, everyone knew everyone else, so all gossip was useful. Today, when we peer into the private lives of fictitious characters, we are giving ourselves the same buzz.

Literature, though, not only delights but instructs. The computer scientist Jerry Hobbs has tried to reverse-engineer the fictional narrative in an essay he was tempted to call "Will Robots Ever Have Literature?" Novels, he concluded, work like experiments. The author places a fictitious character in a hypothetical situation in an otherwise real world where ordinary facts and laws hold, and allows the reader to explore the consequences. We can imagine that there was a person in Dublin named Leopold Bloom with the personality, family, and occupation that James Joyce attributed to him, but we would object if we were suddenly to learn that the British sovereign at the time was not King Edward but Queen Edwina. Even in science fiction, we are asked to suspend belief in a few laws of physics, say to get the heroes to the next galaxy, but the events should otherwise unfold according to lawful causes and effects. A surreal story like Kafka's *Metamorphosis* begins with one counterfactual premise—a man can turn into an insect—and plays out the consequences in a world where everything else is the same. The hero retains his human consciousness, and we follow him as he makes his way and people react to him as real people would react to a giant insect. Only in fiction that is *about* logic and reality, such as *Alice's Adventures in Wonderland*, can any strange thing happen.

Once the fictitious world is set up, the protagonist is given a goal and we watch as he or she pursues it in the face of obstacles. It is no coincidence that this standard definition of plot is identical to the definition of intelligence I suggested in Chapter 2. Characters in a fictitious world do exactly what our intelligence allows us to do in the real world. We watch what happens to them and mentally take notes on the outcomes of the strategies and tactics they use in pursuing their goals.

What are those goals? A Darwinian would say that ultimately organisms have only two: to survive and to reproduce. And those are precisely the goals that drive the human organisms in fiction. Most of the thirty-six plots in Georges Polti's catalogue are defined by love or sex or a threat to the safety of the protagonist or his kin (for example, "Mistaken jealousy," "Vengeance taken for kindred upon kindred," and "Discovery of the dishonor of a loved one"). The difference between fiction for chil-

dren and fiction for adults is commonly summed up in two words: sex and violence. Woody Allen's homage to Russian literature was entitled *Love and Death*. Pauline Kael got the title for one of her books of movie criticism from an Italian movie poster that she said contained "the briefest statement imaginable of the basic appeal of the movies": *Kiss Kiss Bang Bang*.

Sex and violence are not just the obsessions of pulp fiction and trash TV. The language maven Richard Lederer and the computer programmer Michael Gilleland present the following tabloid headlines:

CHICAGO CHAUFFEUR SMOTHERS BOSS'S DAUGHTER,
THEN CUTS HER UP AND STUFFS HER IN FURNACE

DOCTOR'S WIFE AND LOCAL MINISTER EXPOSED FOR CONCEIVING
ILLEGITIMATE DAUGHTER

TEENAGERS COMMIT DOUBLE SUICIDE;
FAMILIES VOW TO END VENDETTA

STUDENT CONFESSES TO AXE MURDER OF
LOCAL PAWNBROKER AND ASSISTANT

GARAGE OWNER STALKS AFFLUENT BUSINESSMAN,
THEN SHOTGUNS HIM IN HIS SWIMMING POOL

MADWOMAN LONG IMPRISONED IN ATTIC SETS HOUSE ON FIRE,
THEN LEAPS TO DEATH

FORMER SCHOOLTEACHER, FOUND TO HAVE BEEN PROSTITUTE,
COMMITTED TO INSANE ASYLUM

PRINCE ACQUITTED OF KILLING MOTHER IN REVENGE
FOR MURDER OF HIS FATHER

Sound familiar? See the endnotes.

Fiction is especially compelling when the obstacles to the protagonist's goals are other people in pursuit of incompatible goals. Life is like chess, and plots are like those books of famous chess games that serious players study so they will be prepared if they ever find themselves in similar straits. The books are handy because chess is combinatorial; at any stage there are too many possible sequences of moves and countermoves for them all to be played out in one's mind. General strategies like "Get your Queen out early" are too vague to be of much use, given the trillions

of situations the rules permit. A good training regime is to build up a mental catalogue of tens of thousands of game challenges and the moves that allowed good players to do well in them. In artificial intelligence, it is called case-based reasoning.

Life has even more moves than chess. People are always, to some extent, in conflict, and their moves and countermoves multiply out to an unimaginably vast set of interactions. Partners, like the prisoners in the hypothetical dilemma, can either cooperate or defect, on this move and on subsequent moves. Parents, offspring, and siblings, because of their partial genetic overlap, have both common and competing interests, and any deed that one party directs toward another may be selfless, selfish, or a mixture of the two. When boy meets girl, either or both may see the other as a spouse, as a one-night stand, or neither. Spouses may be faithful or adulterous. Friends may be false friends. Allies may assume less than their fair share of the risk, or may defect as the finger of fate turns toward them. Strangers may be competitors or outright enemies. These games are taken into higher dimensions by the possibility of deception, which allows words and deeds to be either true or false, and self-deception, which allows *sincere* words and deeds to be either true or false. They are expanded into still higher dimensions by rounds of paradoxical tactics and countertactics, in which a person's usual goals—control, reason, and knowledge—are voluntarily surrendered to make the person unthreatenable, trustworthy, or too dangerous to challenge.

The intrigues of people in conflict can multiply out in so many ways that no one could possibly play out the consequences of all courses of action in the mind's eye. Fictional narratives supply us with a mental catalogue of the fatal conundrums we might face someday and the outcomes of strategies we could deploy in them. What are the options if I were to suspect that my uncle killed my father, took his position, and married my mother? If my hapless older brother got no respect in the family, are there circumstances that might lead him to betray me? What's the worst that could happen if I were seduced by a client while my wife and daughter were away for the weekend? What's the worst that could happen if I had an affair to spice up my boring life as the wife of a country doctor? How can I avoid a suicidal confrontation with raiders who want my land today without looking like a coward and thereby ceding it to them tomorrow? The answers are to be found in any bookstore or video shop. The cliché that life imitates art is true because the function of some kinds of art is for life to imitate it.

Can anything be said about the psychology of *good* art? The philosopher Nelson Goodman came up with an insight while examining the difference between art and other symbols. Suppose by coincidence an electrocardiogram and a Hokusai drawing of Mount Fuji both consisted of the same jagged line. Both tracings stand for something, but the only part of the electrocardiogram that matters is the position of each point that the line passes through. Its color and thickness, the size of the tracing, and the color and shading of the paper are irrelevant. If they were changed, the diagram would remain the same. But in the Hokusai drawing, none of the features may be ignored or casually altered; any might have been deliberately crafted by the artist. Goodman calls this property of art "repleteness."

A good artist takes advantage of repleteness and puts every aspect of the medium to good use. She might as well do so. She already has the eye and ear of the audience, and the work, having no practical function, does not have to meet any demanding mechanical specifications; every part is up for grabs. Heathcliff has to show his passion and fury somewhere; why not against the stormy, spooky Yorkshire moors? A scene has to be painted with brushstrokes; why not use jarring swirls to enhance the impact of a starry night, or a smudge of green on a face to give an impression of the dappled reflections that define the mood of a pastoral scene? A song needs a melody and words; in Cole Porter's "Ev'ry Time We Say Goodbye," a line is sung in alternating verses in a major key and a minor key, and the lyrics are:

> When you're here, there's such an air of spring about it.
> I can hear a lark somewhere begin to sing about it.
> There's no love song finer,
> But how strange the change from major to minor,
> Ev'ry time we say goodbye.

The song is about the change from joy to sadness when parting from a lover; the melody changes from joyful to sad; the lyrics say that the mood changes from joy to sadness using the metaphor of a melody that changes from joyful to sad. In the effort to mold a stream of sound to evoke the change, nothing has gone to waste.

A skillful use of repleteness impresses us not only by evoking a plea-

surable feeling through several channels at once. Some of the parts are anomalous at first, and in resolving the anomaly we discover for ourselves the clever ways in which the artist shaped the different parts of the medium to do the same thing at the same time. Why, we ask ourselves, did a howling wind suddenly come up? Why does the lady have a green spot on her cheek? Why is a love song talking about musical keys? In solving the puzzles, the audience is led to pay attention to an ordinarily inconspicuous part of the medium, and the desired effect is reinforced. This insight comes from Arthur Koestler's tour de force on creativity, *The Act of Creation*, and underlies his ingenious analysis of that other great enigma of human psychology, humor.

WHAT'S SO FUNNY?

Here is how Koestler introduces the problem of humor:

> What is the survival value of the involuntary, simultaneous contraction of fifteen facial muscles associated with certain noises which are often irrepressible? Laughter is a reflex, but unique in that it serves no apparent biological purpose; one might call it a luxury reflex. Its only utilitarian function, as far as one can see, is to provide temporary relief from utilitarian pressures. On the evolutionary level where laughter arises, an element of frivolity seems to creep into a humourless universe governed by the laws of thermodynamics and the survival of the fittest.
>
> The paradox can be put in a different way. It strikes us as a reasonable arrangement that a sharp light shone into the eye makes the pupil contract, or that a pin stuck into one's foot causes its instant withdrawal—because both the "stimulus" and the "response" are on the same physiological level. But that a complicated mental activity like the reading of a page by Thurber should cause a specific motor response on the reflex level is a lopsided phenomenon which has puzzled philosophers since antiquity.

Let's piece together the clues from Koestler's analysis, from more recent ideas of evolutionary psychology, and from actual studies of humor and laughter.

Laughter, Koestler noted, is involuntary noisemaking. As any schoolteacher knows, it diverts attention from a speaker and makes it difficult