HARNESSED

How Language and Music Mimicked Nature and Transformed Ape to Man

MARK CHANGIZI

Praise for Mark Changizi and *Harnessed*

“The theoretical neurobiologist Mark Changizi has a dazzling ability to change the way we think b providing compelling answers to big, important questions that had never occurred to most of us in th first place.”

—ROGER HIGHFIELD, editor of *New Scientist* and co-author of *SuperCooperators*

“In this remarkable book, Mark Changizi performs surgery on the mind, revealing nothing less tha the origins of the abilities that make us human. And his conclusions are both provocative an surprising: The uniquely human facility with language and the universal human propensity to crea and enjoy music came about not through biological adaptation, but through cultural evolution. Huma culture harnessed what our brains already did well—perceiving physical events and huma movements. Changizi’s carefully constructed evolutionary explanation of language and mus promises to revolutionize thinking about what separates us from apes.”

—DAN SIMONS, co-author of *The Invisible Gorilla*

“Among the abundant theories on the origins of language and music, Mark Changizi’s book is uniqu in proposing a very precise hypothesis that leads to many testable and surprisingly accura predictions. Bold, speculative, highly stimulating and entertaining, this book might hold a key to on of humanity’s longstanding mysteries.”

—STANISLAS DEHAENE, author of *The Number Sense* and *Reading in the Brain*

“Mark Changizi is always daring and original, and his theory of how we learned language and mus from nature is truly unique, opening up our ears and eyes to a whole new vision of humanity.”

—DAVID ROTHENBERG, author of *Survival of the Beautiful* and *Why Birds Sing*

“*Harnessed* is one of the most interesting and original books I’ve read in the past few years. Changi is an excellent writer, a compelling theorist, and relentless and ingenious in seeking evidence to bac his theories. His approach to music is at once quite different from other work in the field and y accessible and intelligible. He has answers where others don’t even know how to ask questions. What like about his approach is that he shows how a brain that has been shaped in certain ways has late capabilities that can be harnessed to tasks that are different from those that shaped it. That is a important idea and is certain to yield further insight.”

—WILLIAM BENZON, author of *Beethoven’s Anvil: Music in Mind and Culture*

“A rich tapestry of hypotheses about why language and music sound the way they do.”

—GARY MARCUS, professor of psychology at New York University, and author of *Kluge: Th Haphazard Evolution of the Human Mind*

Praise for *The Vision Revolution*

“The novel ideas that Mr. Changizi outlines in *The Vision Revolution*—together with the evidence h does present—may have a big effect on our understanding of the human brain. Their implication that the environments we evolved in shaped the design of our visual system according to a set of dee principles. Our challenge now is to see them clearly.”

—*The Wall Street Journal*

“The writing style is clear and captivating; the illustrations are nicely done and helpful.” —*Choice*

“Throughout the book, Changizi peppers his explanations with quick, fascinating visual exercises th help to drive his points home. . . . One thing is certain: *The Vision Revolution* will make you wond the next time you notice someone blush, catch a ball or finish reading a magazine page.”

—*Scientific American MIND*

“Filled with optical illusions and simple experiments for the reader to perform, this book may be th most fun you’ll have learning about human cognition and evolution.”

—*The Barnes & Noble Review* online publication

“*The Vision Revolution* is essential science writing, not because the ideas are definitely correct, b because the book can give the ordinary reader an glimpse of how science can work. Changizi unusual in the range and quality of his ideas, and the clarity and humour with which he can lay the out; but the real value of this book is in the excitement of the scientific process that it conveys —*The Psychologist*

“The book contributes an interesting set of new ideas that are explained in a way that should engage wide range of readers.” — *The Quarterly Review of Biology*

“. . . fascinating book” —*New Scientist*

“. . . challenges common notions regarding sight . . . keep[s] them . . . dazzled.” —*Publishers Weekly*

“. . . see how a masterful theorist revisualizes one of the oldest subdisciplines psychology.” —*PsychToday*

Harnessed

How Language and Music Mimicked Nature and Transformed Ape to Man

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Somersault

INTRODUCTION

The Reading Instinct

At the beginning of his book *The Language Instinct*, Steven Pinker demonstrates the amazing power language with an example. He writes:

> The [language] ability comes so naturally that we are apt to forget what a miracle it is. So let m remind you with some simple demonstrations. Asking you only to surrender your imagination t my words for a few moments, I can cause you to think some very specific thoughts:
>
> When a male octopus spots a female, his normally grayish body suddenly becomes striped . . .
>
> Cherries jubilee on a white suit? Wine on an altar cloth? Apply club soda immediately . . .
>
> When Dixie opens the door to Tad, she is stunned, because she thought he was dead . . .

With just a handful of words, our brains are pulled hither and thither to far-off corners of a va mental universe, and new content is installed. For me, the Dixie-and-dead-Tad story from *All M Children* is old news, but a few of you may not have known Tad is alive. And now you know, from ju a few words in the right order.

That kind of brainpower doesn't happen by accident, Pinker argues. The deeply malleable, blank-sla brains the social sciences have long supposed we possess could never learn and do language as we ca Language is astoundingly complicated—to this day, we cannot build effective speech-recognitio machines—and yet we are uncannily good at it: children learn language too quickly and easily, we a comprehend it too automatically and effortlessly, and it pervades our life too completely to b something we simply learn with general-purpose brains. And our brains, indeed, have long appeared t have specialized regions for language. That we have an instinct for language is also suggested by i universality: language is found everywhere, and languages tend to share many common features.

And although Pinker may not extend these arguments to music—he famously called music "audito cheesecake"—other researchers would. Steven Mithen, in *The Singing Neanderthals*, pointed out th music is complex, and yet we're creepily good at processing it; we have seemingly specialized bra regions for it; and music is found virtually everywhere, with certain fundamentally simi characteristics.

To my mind, Pinker's arguments that we are not the universal-learning machines we are ofte believed to be (something he has argued in all his books) are convincing. And his arguments th language possesses all the hallmarks of design (and analogous arguments by others in the case music) are highly persuasive.

Language and music, on the one hand, and the human brain, on the other, are designed to fit on another.

But there is a gnawing problem, one Pinker himself implicitly reveals on the first page of his book, the passage I quoted above: the octopus, club soda, and soap opera excerpts were *written*. My abili to comprehend Pinker's examples—and all his books, and, well, everything I have ever come to kno and admire about him—relied on writing and reading.

Why is reading a problem for the notion of language and music instincts? Because, like language a music, our ability to read *also* has the hallmarks of design . . . and yet we *know* we have no readi instinct.

We know there's no reading instinct because writing is too recent, having been invented only sever thousand years ago; in fact, it didn't take hold among a large fraction of the population until just a fe generations ago. There's a good chance most of your great-great-great-grandparents didn't read.

And yet, despite the fact that we cannot possibly have specialized reading mechanisms in our brai reading has the same appearance of instinct, much like language and music. Reading is astounding complex—to this day, we cannot build effective handwriting-recognition machines—and yet v display machinelike proficiency at reading. Children learn to read at about twice the age at which th can comprehend speech, but when they do learn, their reading experiences are meager compared those for speech. To put it in context, they're often reading before they're competent at pouring mi into cereal, wiping their bottoms, or even engaging in stereotypical ape behaviors like turni somersaults and climbing monkey bars. Once we've learned, we read automatically and effortlessl and reading is arguably more pervasive in our lives today than speech. Our brilliantly capable readi brains even appear to have regions specialized for reading (one is called the "visual word form area' which researchers like the neuroscientists Stanislas Dehaene and Laurent Cohen discuss, and whi Dehaene takes up in his recent book, *Reading in the Brain*. The whiff of a reading instinct is al apparent in the near universality of writing and reading. Writing is found in nearly every huma society today, and there are strong universal tendencies across writing (e.g., in the number of strok per character among phonemic writing systems like ours, and in the ways that strokes can interconne to build characters, something I discussed in Chapter 4 of *The Vision Revolution*).

If we can appear to have a reading instinct without actually having one, perhaps the appearance instincts for language and music is an illusion, too. Perhaps the story of the origins of speech a music is the same as the story underlying our ability to read, whatever that story might be.

It does not escape Pinker's notice that his illustration of language's power is communicated to reader, not a listener. He says in the paragraph following the octopus-soda-soap excerpts:

> True, my demonstrations depended on our ability to read and write, and this makes o communication even more impressive by bridging gaps of time, space, and acquaintanceship. B writing is clearly an optional accessory; the real engine of verbal communication is the spok language we acquire as children.

Writing is optional, Pinker says, but optional for what? Speech and writing serve distinctly differe functions. As Pinker notes, writing, but not speech, can bridge space and time, giving writing a pow akin to a superpower (for example, if I'm dead when you're reading this, then you're not mere reading, but spirit reading!). And as I discuss in *The Vision Revolution*, writing serves functions th audio recordings (which also bridge space and time) cannot, allowing the reader to interact with oth minds and upload content so efficiently that it changed us from *Homo sapiens* to a universal programmable *Homo turingipithecus*. And these distinctive functions of writing are not optiona recorded history and modern civilization depend on it!

At any rate, optional or not, we appear to be designed to read, and yet we have no reading instinc How is this possible?

The answer is that, rather than our brains being designed for reading, reading is designed for o brains. Writing is a technology that has been optimized over time by the forces of cultural selection be good for our visual system. We have no reading instinct. Instead, writing has a brain instinct (i.e is designed for the brain), something neuroscientist Stanislas Dehaene calls "neuronal recycling."

In my research and in my previous book, *The Vision Revolution*, I provided evidence to support specific theory of how culture managed to shape writing for the brain: writing was culturally selecte to look, in fundamental respects, *like nature*, which is the look our evolutionarily illiterate visu system is highly competent at processing. Writing doesn't have a brain instinct so much as a *natu* instinct.

In the case of writing, then, instinct is not responsible for the appearance of design. The designer not natural selection, but cultural selection. The tight fit between reading and the brain is becau reading has been bent to the brain, not the other way around. And the tight fit was achieved via what call *nature-harnessing*: mimicking nature so as to harness evolutionarily ancient brain mechanism for a new purpose.

And now we are poised to see the purpose of *this* book.

If cultural selection can give us writing shaped like nature that is thereby optimized for our visu system, and can do so in just several thousand years, then imagine how well optimized for our brai speech and music may be if they have been culturally evolving for *hundreds* of thousands of years be good for our auditory systems! What if writing, speech, and music are *all* products of culture, but- consistent with the fact that we're not general-purpose machines—they are highly designe technologies shaped for our minds?

And, more specifically, what if, just as writing *looks* like nature, these two auditory capabilities- speech and music—have come to *sound* like nature, and thereby to harness ancient, highly efficie brain mechanisms that were never intended for language or music?

But what in nature might speech and music sound like? *That's* the topic of the book. Before gettin into speech and music, however, we must discuss in more detail the general nature-harnessin approach that I believe explains writing, speech, and music—and explains who we are today. An that's the topic of Chapter 1.

CHAPTER 1

Nature-Harnessing

DEEP SECRETS

It isn't nice to tell secrets in front of others. I recently had to teach this rule to my six-year-o daughter, who, in the presence of other people, would demand that I bend down and hear a whispere message. To my surprise, she was genuinely perplexed about why communicating a message only me, in the presence of others, could possibly be a bad thing.

Upon thinking about it, I began wondering: What exactly *is* so bad about telling secrets? There a circumstances in which telling secrets would appear to be the appropriate thing to do. For example, Dick and Jane are over for a formal dinner at my house, and in order to spare my wife son embarrassment I lean over and whisper, "Honey, there's chocolate on your forehead," is that wrong Wouldn't it be worse to say nothing, or to say it out loud (or in a published book)?

The problem with telling secrets is not that there aren't things worth telling others discreetly. Rathe the problem is that when we see someone telling a secret, it taps into a little program in our head th goes, "That must be very important information—possibly about *me*. Why else keep it from me?" Th problem with secrets is that we're all a bit paranoid, and afflicted with a bad case of "me, me, me The result is that secrets get imbued with weighty importance, when they mostly concern suc sundries as foreheads and sweets.

Not only do we tend to go cuckoo over the covert, attributing importance to unimportant secrets, b we also have the predisposition to see secrets where there are none at all. Our propensity to s nonexistent secrets has engendered some of the most enduring human preoccupations: mysticism an the occult. For example, astrology, palm reading, and numerology are "founded" upon supposed secr meanings encoded in the patterns found in stars, handprints, and numbers, respectively. Practitione of mysticism believe themselves to be the deepest people on Earth, dedicated to the ancient secrets the universe: God, life, death, happiness, soul, character, and so on. Astrological horoscopes don predict the morning commute, and palm readers never say with eerie omniscience, "Don't eat th yogurt in your fridge. It's moldy!" The secrets are not only deep, but often personal: they're abo ourselves and our role in the universe, playing on our need for more "me, me, me."

Even those who pride themselves on not believing in mystical gobbledygook often still enjoy a goo dose of deep ancient secrets in fiction, which is why Dan Brown's *The Da Vinci Code* did so well. that novel secret codes revealed secret codes about other secret codes, and they all held a meaning s deep that people were willing to slay and self-flay for it.

Secrets excite us. But stars, palms, and numbers hide no deep, ancient secrets. (Or at any rate, not th sort mystics are searching for.) And stories like the *The Da Vinci Code* are, well, just stories. What shame our real world can't be as romantic as Dan Brown's fictional one, or the equally fictional on mystics believe they live in. Bummer.

But what if there *are* deep and ancient secrets? Real ones, not gobbledygook? And what if thes secrets *are* about you and your place in the universe? What if mystics and fiction readers have bee looking for deep secrets in all the wrong places?

That's where this book enters the story. Have *I* got some deep secrets for you! And as you will se
these ancient secrets are much closer than you may have thought; they're hiding in plain sight. In fac
as I write these very words I am making use of three of the deepest, ancientest secret codes there ar
What are these secrets? Let me give you a hint. They concern the three activities I'm engaged in rig
now: I am *reading* (my own writing), *listening to speech* (an episode of bad TV to keep me awake at
a.m.), and *listening to music* (the melodramatic score of the TV show). My ability to do these thr
things relies on a code so secret few have even realized there's a code at all.

"Code, schmode!" you might respond. "How lame is that, Changizi? You tantalize me with *dee*
secrets, and yet all you give me are run-of-the-mill writing, speech, and music! Where are the ancie
scrolls, Holy Grails, secret passwords, and forgotten alchemy recipes?"

Ah, but . . . I respond. The secrets underlying writing, speech, and music *are* immensely deep one
These secret codes are so powerful they can turn apes into humans. As a matter of fact, they did *tu*
apes into humans. That's deeper than anything any mystic ever told you!

And it is also almost certainly truer. So shove that newspaper horoscope and that Dan Brown novel o
your coffee table, and make room for this nonfiction story about the deepest ancient secret codes w
know of . . . the ones that created us.

To help get us started, in the following section I will give you a hint about the nature of these code
As we will see, the secret behind the codes is . . . *nature itself*.

MOTHER NATURE'S CODE

If one of our last nonspeaking ancestors were found frozen in a glacier and revived, we imagine th
he would find our world jarringly alien. His brain was built for nature, not for the freak-of-natu
modern landscape we humans inhabit. The concrete, the cars, the clothes, the constant jabbering—it
enough to make a hominid jump into the nearest freezer and hope to be reawakened after th
apocalypse.

But would modernity really seem so frightening to our guest? Although cities and savannas woul
appear to have little in common, might there actually be deep similarities? Could civilization hav
retained vestiges of nature, easing our ancestor's transition? And if so, why *should* it—why woul
civilization care about being a hospitable host to the freshly thawed really-really-great-uncle?

The answer is that, although we were born into civilization rather than melted into it, from a
evolutionary point of view we're an uncivilized beast dropped into cultured society. We prefer natur
as much as the next hominid, in the sense that our brains work best when their computational
sophisticated mechanisms can be applied as evolution intended. Living in modern civilization is *n*
what our bodies and brains were selected to be good at.

Perhaps, then, civilization shaped itself for *us*, not for thawed-out time travelers. Perhaps civilizatio
possesses signature features of nature in order to squeeze every drop of evolution's genius out of ou
brains for use in the modern world. Perhaps we're hospitable to our ancestor because we have bee
hospitable to *ourselves*.

Does civilization mimic nature? I believe so. And I won't merely suggest that civilization mimi

nature by, for example, planting trees along the boulevards. Rather, I will make the case that some
the most fundamental pillars of humanity are thoroughly infused with signs of the ancestral world .
and that, without this infusion of nature, the pillars would crumble, leaving us as very smart hominin
(or "apes," as I say at times), but something considerably less than the humans we take ourselves to
today.

In particular, those fundamental pillars of humankind are (spoken) language and music. Language is
the heart of what makes us apes so special, and music is one of the principal examples of our unique
human artistic side.

As you will see, the fact that speech and music *sound like other aspects of the natural world* is cruci
to the story about how we apes got language and music. Speech and music culturally evolved ov
time to be simulacra of nature. Now *that's* a deep, ancient secret, one that has remained hidden despi
language and music being right in front of our eyes and ears, and being obsessively studied
generations of scientists. And like any great secret code, it has great power—it is so powerful it turne
clever apes into Earth-conquering humans. By mimicking nature, language and music could
effortlessly absorbed by our ancient brains, which did *not* evolve to process language and music.
this way, culture figured out how to trick nonlinguistic, nonmusical ape brains into becoming mast
communicators and music connoisseurs.

One consequence of this secret is that the brain of the long-lost, illiterate, and unmusical ancestor
unthaw is no different in its fundamental design from yours or mine. Our thawed ancestor might
just fine here, because our language and music would harness *his* brain as well. Rather than jumpi
into a freezer, our long-lost relative might instead choose to enter engineering school and invent th
next-generation refrigerator.

The origins of language and music may be attributable, not to brains having evolved language a
music instincts, but rather to language and music having culturally evolved *brain instincts*. Languag
and music shaped themselves over many thousands of years to be tailored to our brains, and becau
our brains were cut for nature, language and music mimicked nature . . . and transformed ape to man.

UNDER THE RADAR

If language and music mimic nature, why isn't this obvious to everyone? Why should this hav
remained a secret? It's not as if we have no idea what nature is like. We're not living on th
International Space Station, and even those who are on the Space Station weren't *raised* up there! W
know what nature looks and sounds like, having seen and heard countless examples of it. So, given o
abundant experiences of nature, why haven't we noticed the signature of nature written (I propose) a
over language and music?

The answer is that, ironically, our experiences with nature don't help us consciously comprehend wh
nature *in fact* looks and sounds like. What we are aware of is already an assembled *interpretation*
the actual data our senses and brains process. This is true of you whether you are a couch pota
extraordinaire or a grizzled expedition guide just returned from Madagascar and leaving in th
morning for Tasmania.

For example, I am currently in a coffee shop—a setting you'll hear about again and again—and when
look up from the piece of paper I'm writing on, I see people, tables, mugs, and chairs. That is, I a

consciously aware of seeing these *objects*. But my brain sees much more than just the objects. M
early visual system (involved in the first array of visual computations performed on the visual inp
from the retina) sees the individual contours, and does *not* see the combinations of contours. M
intermediate-level visual areas see simple combinations of several contours—for instance, obje
corners such as "L" or "Y" junctions—but don't see the contours, and don't see the objects. It is m
highest-level visual areas that see the objects themselves, and I am conscious of my perception
these objects. My conscious self is, however, rarely aware of the lower hierarchical levels of visu
structure.

For example, do you recall the figure at the start of the chapter—the person's head with a lock and ke
on it? Notice that you recall it in terms referring to the *objects*—in fact, I just referred to the imag
using the terms *person*, *head*, *lock*, and *key*. If, instead, I were to ask you if you recall seeing the figu
that had a half dozen "T" junctions and several "L" junctions, you would likely not know what I w
talking about. And if I were to ask you if you recall the figure that had about 40 contours, and I the
went on and described the geometry of each contour individually, you would likely avoid me
cocktail parties.

Not only do you (your conscious self) not see the lower-level visual structures in the image, yo
probably won't find it easy to talk or think about them. Unless you have studied computational visio
(i.e., studied how to build machines that see) or are a vision scientist, you probably haven't thoug
about how contours intersect one another in images. "Not only did I not see T or L junctions in th
image," you might respond, "I don't even know what you're talking about!" We also have gre
trouble talking about the orientation and shapes of contours in our view of three-dimensional scen
(something that came to the fore in the theory of illusions I discussed in *The Vision Revolution*).

Thus, we may *think* we know what a chair looks like, but in a more extended sense, we have little ide
especially about all those lower-level features. And although parts of our brain *do* know what a cha
looks like at these lower levels, they're not given a mouthpiece into our conscious internal speec
stream. It is our inability to truly grasp what the lower-level visual features are in images that explai
why most of us are hopeless at drawing what we see. Most of us must undergo training to becon
better at accessing the lower levels, and even some of the great master painters (such as Jan Van Eyc
may have projected images onto their canvases and *traced* the lower-level structures.

Not only do we not truly know what nature looks like, we also don't know what it *sounds* like. Whe
we hear sounds, we hear the meaningful events, not the lower-level auditory constituents out of whic
they are built. I just heard someone at the next table cutting something with her fork on a ceram
plate. I did not consciously hear the low-level acoustic structure underlying the sound, but my lowe
level auditory areas *did* hear just that.

For both vision and audition, then, we have a hierarchy of distinct neural regions, each a homuncul
("little man") great at processing nature at *its* level of detail. If you could go out for drinks with the
homunculi, they'd tell you all about what nature is like at lower and middle hierarchical scales. B
they're not much for conversation, and so you are left in the dark, having good conscious access on
to the final, highest parts of the hierarchy. You see objects and hear events, but you do not see or hea
the constituents out of which they are built.

You may now be starting to see how language and music could mimic nature, yet we could be unawa
of it. In particular: what if language and music mimic all the lower- and middle-level structures

nature, and only fail to mimic nature at the highest levels? All our servant homunculi would b
happily and efficiently processing stimuli that appear to them to be part of nature. And yet, becaus
the stimuli may have a structure that is not "natural" at the highest hierarchical level, our conscio
self will only see the *dissimilarity* between our cultural artifacts and nature.

Why should we believe what we can't consciously perceive—that language and music mimic nature
all but the highest hierarchical level? Why not go all the way and make language and mus
completely like nature?

Let's not forget that language and music are not *merely* trying to mimic nature. They have *jobs* to d
writing is for putting thoughts on the record, speech is for transmitting thoughts to others, and mus
is perhaps for something like evoking feelings in others. Language and music want to capture as muc
of the structure of nature as they can so that they have an easy ride into our brains, but they must serv
their purpose, and will have to sacrifice nature-mimicry when it is necessary to do so.

So one can see how sacrifices of nature-mimicry may sometimes be part of doing business. But wh
should the sacrifices be up near the top, where we have greater conscious access? The principal reaso
for this is that if the earlier regions of the hierarchy receive stimuli that *they* can't make any sense o
then they will output garbage to the next higher level, and so all levels above the unhappy level will b
unhappy. Breaking nature-mimicry at one level will break it at all higher levels.

For example, I have argued in earlier research and in *The Vision Revolution* that writing looks lik
nature. In particular, I have suggested that written words look like visual objects. But words do n
necessarily look natural at *all* levels up the hierarchy. Strokes look like contours, and letters look lik
object junctions; and thus the lower and middle levels of your visual hierarchy are happy. But becaus
in alphabetic writing systems the letters in a word depend on how it is spoken, there is no effectiv
way to make entire words look like objects. (For example, the junction-like letters in the words yo
are currently reading are simply placed side by side, which is not the way junctions in scenes a
spatially related.) Your highest-level regions, of which you are most directly aware, only notice th
nonnatural look of written words. And when visual signs do more closely match the visual structure o
objects at the highest levels, people *do* see the resemblance to nature—this is why trademark logo
and logographic writing systems like Chinese look (to your conscious self) much more object-lik
than the words you're reading here.

My claim in this book that language and music mimic nature must be understood in this light. I clai
that they mimic nature, indeed, but not necessarily "all the way up" The reason why writing, speec
and music don't *obviously* seem like nature is that nature is *not* being injected at the higher level
perhaps—as we've seen with writing—in order to better accomplish the functions they are designed
carry out.

We see, then, why it is that the nature-mimicry in language and music has remained a secret for s
many millennia. If only your lower-level visual and auditory areas could speak! They'd have long ag
let you know that language and music are built like nature. Because those lower homunculi are *part*
you, there is a sense in which you have known about this ancient, deep secret code all along. Pieces
meat inside you knew the secret, but weren't telling. In this light, one can view this book as a kind
psychoanalysis—if you're into that—digging up the homunculus-knowledge you already have dee
inside you, and working through the ways it shaped who you are today.

NATURE'S HARD CORE

"Language and music mimic nature."

I *will* try to convince you of that over the course of this book. But we humans are very bad judges whether a stimulus is natural or not, as we just finished discussing. How, then, are we to have any ide whether language and music do or do not mimic nature? And isn't the phrase "mimicking nature awfully imprecise?

Indeed, it *is* imprecise. Part of the book's point is to make this more precise—to say *specifical which* aspects of nature are mimicked by language and music. But can this really be done? How ca we possibly know the details of the natural world our ancestors experienced? It is, after all, *th* version of nature that our brains evolved to be good at processing, and that was a long time ago. order to show that language and music mimic the primordial natural habitats that shaped our brains, would seem that we have no choice but to start familiarizing ourselves with the sights and sounds the savanna, and wherever else our ancestors hung out.

A field trip is in order. Like all natural habitats, savannas feature a hodgepodge of characters an settings, and we must take a visual and auditory inventory. We will need images from all over th savanna, including acacia trees, tall grass, sunsets, rocks, giraffes, lions' manes, and termite mound And we will need to record the sounds within those habitats, including wind, rustling leaves, bi calls, insect buzzes, and rhino grunts. Once we have built an encyclopedia of how our ancestral wor looked and sounded, we can *then* ask whether language and music mimic nature.

Hold it right there! Sorry, but I'm pulling your leg. That is definitely *not* what we're going to d Trekking across the Serengeti with a camera and tape recorder sounds grand, but it isn't the route to compelling scientific explanation. We want *generalizations* about what visual nature looked an sounded like for our ancestors, not merely an itemized list of all the furniture in the savanna. We nee to grasp the fundamental "grammar" of nature. We need to pick apart nature, carve it at its joints, an elegantly summarize its structure. With such a "grammar" in hand, we will be able to make powerf predictions about what a nature-mimicker should be like . . . and thus, what language and mus should be like.

Might there be fundamental regularities that cut across a wide swath of terrestrial habitats? Could be that, although there are large salient differences across habitats, there are nevertheless deep respects in which they are all similar? Although the savanna and any other specific habitats shapin our ancestors have hosts of peculiar features, might the sights and sounds of these habita nevertheless have the same fundamental "core grammar"?

If there *is* a "core grammar" to nature, then this core would have been a highly steady invariant ov our evolutionary history, and would thus have been a strong shaper of our visual and auditory system Sensory structure specific to the savanna or other particular habitats would, on the other hand, hav been highly variable and intermittent over evolutionary time, and consequently less important f understanding what our visual and auditory systems became good at.

It's this hard core of nature that we want. But is there one? Yes, indeed. There *are* solid co grammars underlying the structure of visual and auditory nature—there are "universals" in th structure of nature. That's what I'll endeavor to show you in this book; and *then* I'll show you th

language and music mimic these cores. I'll give you a preview of these hard cores in the next sectio
when I introduce the central tenets of the theory—that is, when I first reveal the big secrets.

THE REVEAL

At this point, we have discussed the possibility that language's and music's mimicry of nature cou
be what enabled us humans to acquire language and music. We also took up why, if this were so,
would not be obvious to us. And in the section just above, I made myself clearer about the role th
"nature" will play in understanding the origins of language and music: the goal is to find fundament
principles underlying the structure of nature (as opposed to a catalog of savanna paraphernalia),
that we'll be in a strong position to ask whether these fundamental principles underlie language a
music.

What I have *not* yet done is give you any specifics on what the hard cores in nature *are* that are bei
mimicked by language and music. That is, I haven't revealed what any of the "ancient secrets" mig
actually be. Let's rectify that, and simultaneously summarize the book's two main theses, concernin
speech and music.

Chapter 2 of the book is about the secret code underlying speech. Here's the secret: *human spee
sounds like solid-object physical events*. Notice that this secret makes no mention of rustling leaves
rhino grunts. Instead, the "nature" that speech mimics encompasses a very broad class of event
namely those among solid objects. The main observation is that events involving solid objec
bumping and crashing about have a signature core auditory structure, and I will provide evidence th
human speech has this signature structure. Speech can thereby get into our brains by harnessin
auditory-recognition mechanisms we have long possessed for processing the "pinball" sounds
nature. This secret code gives us hominids the power to recognize speech without having speec
recognition mechanisms.

And here is the deep secret underlying music, which is the topic of Chapters 3, 4, and 6: *music soun
like humans moving and behaving (usually expressively)*. Notice how general the notion of "nature"
here. It isn't the sounds of people's heartbeats, or heavy breathing, or missionary-style sex,
skipping—it is the sounds of humans behaving. When we carry out behaviors we tend to make nois
and our auditory system can infer a lot about each other's behavior from the noise. Music has th
signature auditory structure of humans doing stuff, and can thus get into our brains by tapping into o
auditory recognition mechanisms for identifying the actions of other people. No music-processin
mechanisms are required. This secret code of sounding like expressive human movers is what allow
music to flow into our auditory system and be understood by it, even though we possess no speci
brain gears for processing music.

Although it is the ancient secret codes lying beneath speech and music that I'll be whispering about
this book, this is not the first time I have written about deep secrets of this kind. In my previous boo
The Vision Revolution, I wrote about (among other topics) another ancient secret, the one explainin
how we hominids came to have a *written* history. And the secret is this: *writing looks like thre
dimensional scenes with opaque objects*. Writing looks like nature, but as before, nature of a ve
general kind—no images of acacia trees or termite mounds are needed. Writing has come to mim
the contour combinations occurring in natural scenes with opaque objects, and in such a way th
written words mimic the structure of visual objects. Writing gets into our brains by harnessing o

visual object-recognition mechanisms. The secret code of looking like nature is what allows writing be read by us hominids without any reading mechanisms in our brains.

The "nature" stories of the origins of speech, music, and writing are, then, not in the least about acac trees or the other particulars in the rummage shop of our ancestors, but rather about solid-obje physical events, human movement sounds, and opaque objects in a three-dimensional world. "Nature is a highly general notion, just what is needed to make theoretical headway and empirical testi possible and practical.

And although the notions of "nature" I will rely on are very general, they are not so general that the include everything. For example, "solid-object physical events" covers a wide swath, but it doesn cover sounds made by air and water. And "opaque objects in a three-dimensional environment" fundamental, but a habitat with semitransparent objects (like clouds at high altitudes) would not b included.

Distinguishing between the surface features of habitats (which vary wildly from habitat to habitat) an the core features (found in most or all habitats) is helpful in understanding why, even if writin speech, and music have underlying core similarities, they nevertheless come in such tremendou variety. If nature were all core—if it had little or no variability across habitats—then our visual an auditory systems would have evolved to be competent at processing just the very specific kinds stimuli in the world. Language and music that harnessed such a brain would be expected to have very specific and consistent surface structure, something they do not, in fact, have. If, instead, as is th case, there is a small core of invariant structure to nature, yet loads of variability across habitats, on would expect us to end up with brains that are more open-minded about what they're willing to accep Our brains would be most competent at processing stimuli that have the core signature, but in oth respects, our brains would be open to many variants. Language and music that harnessed this kind open-minded brain would be expected to take widely varying shapes across cultures, but to sha certain similarities. This is a much more accurate description of language and music as found o Earth: subject to large differences across cultures, but sharing certain core structural characteristi across cultures.

You have now gotten a peek at the ancient secret codes hidden inside speech and music. Hopefully yo can appreciate their generality, and appreciate why it might be that the natural structure in speech an music has stayed hidden from us. In the next and final section of this chapter, I will be as clear as can about how my nature-harnessing theory differs from other stances on the origins of language an music, and I will justify why we should *expect* language and music to have nature instincts (i.e designed to mimic nature) rather than just brain instincts (i.e., designed to be well shaped for th brain).

PURPS VS. QUIRKS

In the Introduction, I touched upon two standard, contrasting viewpoints on origins, the first being th we evolved brains specialized for language and music (i.e., we have instincts for these things), and th second that, on the contrary, we evolved to be general-purpose, universal learning machines th handle these artifacts because we can learn *lots* of unusual stuff. I suggested that language and mus seem unlikely to be instincts because writing, too, reeks of instinct, but is definitely not an instinc But I also intimated that there is a wealth of data and argument—summarized and argue

convincingly in Pinker's books, for example—that we do not possess blank-slate brains. How, the
are *predisposed* brains like ours able to learn any human language and comprehend music—among th
most complex and sophisticated computational tasks on Earth—if we're neither designed specifical
for it nor particularly impressive general learners?

The answer is that once culture got up and running, there was a new blind watchmaker in tow
Cultural evolution could, over comparatively short periods of time, fit language and music into th
shapes our grooved (non-blank-slate) brains are able to learn. It is not so much that our brains lea
language and music, but rather that culture learned how to package language and music so that they f
right into our brains. Culture learned how to harness us.

Despite the title of this book, there is nothing new about the idea that we are harnessed by culture, th
cultural artifacts may have been selected to be structured well for our brains. What *is* new here is th
I am putting forth specific proposals for how culture actually goes about harnessing us. Saying th
language and music might be shaped for the brain doesn't take us very far in understanding the shap
of language and music, because we don't have a good understanding of the brain. What we need is
general theory of harnessing. And *nature-harnessing* is the theory I am proposing.

Earlier I said that language and music have evolved to possess a brain instinct, rather than the bra
having evolved to possess language and music instincts. But in a sense, in this book I am arguing th
language and music have, not a brain instinct, but a *nature* instinct. Language and music carry in the
the structure not of the brain so much as of nature, which of course is just right for the brain—becau
the brain is just right for nature (see Figure 1).

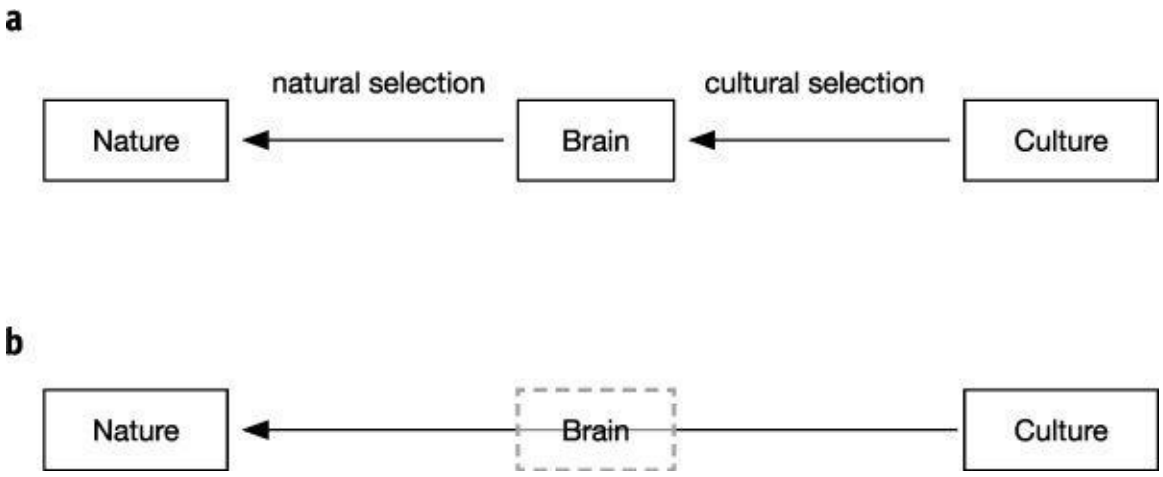

Figure 1. **(a)** The brain was shaped by natural selection for nature, and culture was shaped by cultur
selection for the brain. **(b)** By shaping culture to look like nature, culture will tend to end up shape
well for the brain. And, importantly, we scientists can hope to get a handle on this without having t
understand the detailed brain mechanisms. The arrow cutting through the brain and going from cultu
to nature is meant to symbolize my nature-harnessing theoretical approach, which drives this book.
means that my theory will pretend there is a single arrow like this, where culture has been selected
be shaped like nature. This is a simplification of the more detailed picture in **(a)**, and the great
simplicity is a boon to a scientist because the most complicated object in the universe—the brain-
has been removed from the "equation."

We have to be more careful, however, because brains optimized for nature can sometimes lik
nonnatural things as well. Our mechanisms have been selected for because they work very well on th

inputs our ancestors would have experienced. When those natural stimuli are the input, o
mechanisms work as they are supposed to—it's their purpose (or "purp").

But those same mechanisms don't typically just sit quietly when nonnatural stimuli are inputted in
them. They do *something*. And what they do depends entirely on the implementation details of th
mechanism. Because the mechanism wasn't designed to handle that kind of input, who knows what th
mechanism might do? Mechanisms have *quirks*. For example, it is presumably a quirk that certa
flashing lights have a propensity to induce seizure.

Brains were selected for their purps, but they end up with lots of quirks as well. When language an
music culturally evolved to be structured for our brains, it didn't matter whether it was the purps
the quirks that were harnessed, so long as the process worked. But if language and music actual
came to harness our quirks more than our purps, then the strategy that culture uses would not b
nature-harnessing so much as *quirk*-harnessing. And if *that* were the case, I wouldn't have much of
book left! That is, in this book I am claiming that the principal strategy culture used to harness o
brains for language and music is not quirk-harnessing, but purp-harnessing . . . and that culture did i
purp-harnessing by mimicking nature, just the thing to ensure that our brain mechanisms run
"purposely" designed.

So, is harnessing about the purps or the quirks? Does culture harness the brain by looking an
sounding like nature and thus making the brain function as intended, or does it harness the brain b
shaping itself in a way that elicits the brain to function in some quirky accidental manner? Because,
I just said, cultural evolution doesn't care what it harnesses so long as it works, both purps and quir
are surely both part of the full story of how language and music fit themselves to us. There's n
reason, then, to expect that the quirks should completely *dominate* the story of harnessing. And
that's the case, then there's a role for the purps, and for nature-harnessing. Whew!

Actually, I can say more than just that nature-harnessing is unlikely to be completely useless fo
understanding harnessing. On the contrary, I expect nature-harnessing to be the *key* to how cultur
evolution harnessed us, and quirks to be just a small side story. There are two reasons why I don
think the quirks are the main driver. The first reason is that quirks are not smart enough, and th
second reason is that *I* am not smart enough.

Stupid quirks first. If I were to open up the "V" of a stapler, hold one end in my hand, and try to h
you with the swinging end, then I would have created a hitting device (and lost a reader). I wou
thereby have harnessed the stapler for a new function. But I would have harnessed a *quirk* of th
stapler, not a purp. Staplers are not designed to be weapons, or to be swung around like that, at al
They are, accordingly, unlikely to be any good at it; at best, they'll be *nowhere near* as efficient
tools designed for hitting. My stapler hitting device is, in essence, the worst pair of nunchucks ev
devised. You don't get powerful functionality by accident. If, instead, I were to use the stapler t
fasten a pile of leaves together, that would be a case where I have harnessed the *purp*. Staplers ma
not be for stapling leaves, but leaves clearly resemble paper (in the respects relevant for staplers
which is just what staplers *were* designed for. So, the first reason why quirk-harnessing will be
minimal part of the story of harnessing is that cultural selection will favor the bits of us that a
highly engineered masterpieces, not accidental side effects.

Quirks may be stupid, but cultural evolution may sometimes tap into them anyway. After all, wh
hasn't tried to remove a staple with a pen tip, or tried to bang a nail in with the handle of

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