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AMERICAN FEDERATION OF TEACHERS
FALL 2002

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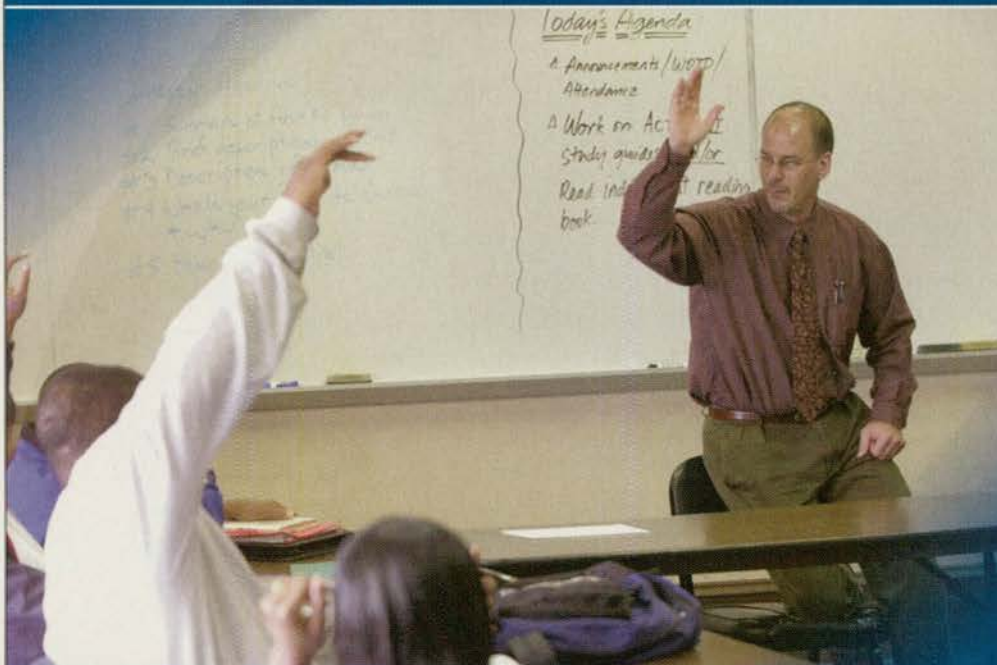
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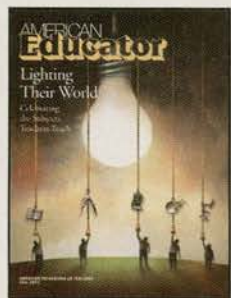
A Community of Saints
By Lionel Trilling

A testament to the possibility of interracial respect and friendship, Huckleberry Finn is now the most-taught piece of American literature in American high schools. Speaking to us from the year 1948, literary critic Lionel Trilling analyzes this "subversive book," noting that no one who reads it will be able to accept without question the assumptions of the morality by which he lives.

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Cover illustrated by Michael Gibbs

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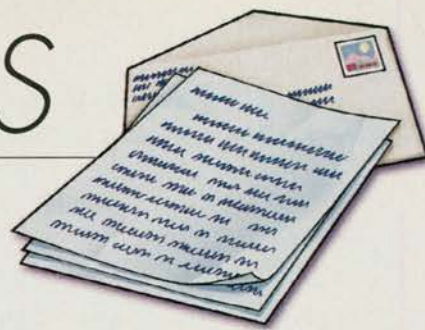
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LETTERS



The Absent Curriculum: A National Problem

"Lost at Sea" (Summer 2002) described accurately the challenges—and travails—of my first year teaching (2001-02). Nothing less than four hours per evening on school days, and six to eight hours per day on weekends, of lesson and assignment planning were necessary for me to survive my "rookie year." The assistance and encouragement of my mentor, principals, and colleagues were invaluable in getting me through—but I wonder how much saner, and more rewarding, my first year in teaching could have been had I had a well-defined curriculum.

Having entered teaching in a mid-life career change after 20 years of experience in the business world and military, I felt better prepared than the 22-year-old recent education graduate. However, the lack of materials, confusing and overwhelming resources, and sometimes conflicting but well-meaning advice made the challenges in my previous careers pale by comparison. Every evening, as I looked forward to another four- to five-hour stint of preparation for the next day, I felt like a playwright in Purgatory: Prepare yet another lesson/activity from scratch or find yourself cast forever into the Outer Darkness.

A suggestion: In lieu of a comprehensive curriculum at the state or district level, school departments should organize a library of unit and lesson plans, assignments, and classroom activities that new teachers may use to get them through the crucial first year. Either this, or hope that your rookie teachers survive Purgatory.

—ANTHONY CASTELLANO
South High
Minneapolis, MN

Thank you, thank you for the most riveting, right-on article I've ever read in an educational journal. The lack of curriculum guidance is the biggest single burden that a teacher (old or new) faces. I thought that the state of Florida was sadly remiss—I didn't know that there were other states in the same shape.

How can a lone teacher battle the daily stresses of classroom teaching and be expected to also map out her entire term considering all of the accountability today? Also, with no curriculum guide for anyone, how can you be sure that you're covering all the bases leading up to the next grade?

During my last five years of teaching, I taught high school English and English for speakers of other languages. In four years time, I taught English for ninth, 10th, 11th, and 12th grades. All of this while also teaching ESOL, and all of this with no curriculum guides.

I retired after 20 years of varied teaching jobs in Florida. Certainly I have some good memories, but also some scars. I feel very heartened that someone out there is aware. Maybe there is hope. Best wishes.

—DOTTY LOOP
Just-retired school teacher
St. Augustine, FL

I thank the staff of *American Educator* for responsibly reporting our need for a change in our curriculum. The articles on "A Common, Coherent Curriculum" (Summer 2002) bring to the forefront obstacles we face when deciding what to teach our students. I have taught fourth and fifth grades in Florida for five years and have been overwhelmed by the amount of curriculum students are expected to master. If students actually were able to

learn all of the fourth- and fifth-grade Sunshine State Standards for science and social studies, they would have a complete high school curriculum before age 11. It is completely unrealistic to expect that all students can be taught such numerous and diverse topics and gain deep understanding. The TIMSS research clearly shows the redundancy and ineffectiveness of the U.S. math curriculum. As teachers, we are faced with the daunting task of picking core elements to focus on so that learning does take place—rather than bombarding students with a smattering of facts to be forgotten the following year. If we are to truly see a change in the “mile wide, inch deep” approach to curricular planning, quality professional development is essential.

I was fortunate to find such assistance in the Thinking Mathematics courses, part of AFT’s larger Educational Research and Dissemination Program. This research-based and in-depth program challenged me to analyze my teaching strategies and evaluate our local and state curricula. It is what has saved me from being “Lost at Sea.”

Thanks to the pioneering vision of Lovely Billups and the continuing leadership of Alice Gill, Thinking Mathematics continues to provide the profes-

sional development that can truly impact how teachers teach math and how they view curriculum.

—AMY UTTER SPIES
Creekside Middle School
Port Orange, FL

To learn more about the AFT’s Thinking Mathematics courses, as well as other courses offered by the Educational Research and Dissemination Program, please visit www.aft.org/edissues/teachers/index.htm.

I am moved to respond to your articles about various aspects of the curriculum with a simple observation. In the 35 years that I was a classroom teacher, I saw multiple “Perfect Systems” disseminated by the California State School Board via its Education Department. If the United States Banking System were subjected to annual changes in its business methods, that system, too, would be in a shambles that no amount of money or head-scratching could fix. Does anybody have any idea how much time and money are being diverted to these on-going changes-for-the-sake-of-change antics? Do they understand what these constant changes are costing the students of this state? Do they care? Thank you.

—DENNIS WALTER
Long Beach, CA

Thank you so much for providing your readers with so much needed information on what first-year teachers go through. The story “Lost at Sea” reminded me of my early years of teaching—entering a classroom that was unpainted and devoid of up-to-date textbooks. The principal basically gave me a class list (of 30 students), thrust me inside, and left with the haunting words “Good Luck.” It was then that I realized I would be practically on my own, with no real curriculum handed me—and thus left to fend for myself and make up the curriculum as the days turned into weeks and the weeks turned into months.

Both stories, “Lost at Sea” and “The Cascading Benefits of a Common, Coherent Curriculum” address the issue of the teacher as a lonely warrior and long

distance runner very well. What both fail to address, however, is that it would still be very difficult to execute any curriculum thoroughly if the issue of class size is not addressed. Teaching a class of 32 students, which I did this past year, continues to be a challenge. Not only is the teacher faced with the large numbers in the class, but also the challenge of meeting the varying needs of diverse students. In a typical sixth-grade class, the reading level usually ranges from second to eighth grade. Being asked to follow the standards is an uphill battle with the large numbers. Let’s lower the class sizes first, then address the curriculum. Hopefully, then, one won’t continue to feel “lost at sea.”

—DARRYL ALLADICE
Brooklyn, NY

IB: “I’ve Died and Gone to Heaven”

Thank you so much for printing Robert Rothman’s in-depth article about the International Baccalaureate Program (“A Test Worth Teaching To,” Summer 2002). I have worked IB for the last seven years, and I am surprised by how many people know nothing about it.

I am a Spanish instructor, entering my 35th year teaching this fall. The last seven years I have been teaching the pre-IB and IB Spanish students at Cocoa Beach Jr./Sr. High School in Cocoa Beach, Fla. I feel like “I have died and gone to heaven.” Not only is the curriculum wonderful and very “reality-based,” but the students truly want to learn and work with you. As Mr. Rothman said, the role of the teacher is no longer adversarial—we all work together! And my students cannot believe at course’s end that they are fluent in Spanish. It is an absolute thrill for me.

Also, last December I was invited to Cardiff, Wales, the home of the International Baccalaureate, to watch the Spanish professors grade and grid the Spanish (Language A) examinations of the southern hemisphere. It was fascinating, to say the least.

—DONALD A. BARLOW
Cocoa Beach Jr./Sr. High School
Cocoa Beach, FL

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Let us know what you think!

Please send letters to the editor via e-mail to amered@aft.org or by mail to American Educator, 555 New Jersey Ave. N.W., Washington, DC 20001. Published letters may be edited for style, clarity, and length.

Curing Provincialism

Why We Educate the Way We Do

A Conversation with Jacques Barzun

*Jacques Barzun has been a presence on the American intellectual scene for most of the past century. He has written more than 30 books, and countless essays, on cultural, historical, and educational topics. Early in his career, he wrote *Teacher In America*, still in print, which drew on his own teaching experiences. In 2000, at over age 90, Barzun published *From Dawn to Decadence: 500 Years of Cultural Life, 1500 to Present*. *The American Scholar* called it a "masterwork" by a "man whose entire life has been spent acquiring the perspective that only wisdom, and not mere knowledge, can grant." At 800 pages, it still made the *New York Times* bestseller list—demonstrating both Barzun's knowledge and wit and the public's appetite for history. He is a natural to talk with about the subjects we teach. This interview was conducted by American Educator Editor Ruth Wattenberg.*

Editor: The core academic subjects of the K-12 curriculum are widely considered to be literature, history, the arts, science, and math. In your view, should these be the core?

Barzun: You have named the subjects I think essential if what we call our tradition is to be handed down instead of forgotten within a couple of generations. They are the subjects that have the power to open our minds, free our thinking from conventional opinion, and discipline our minds to think productively. Each subject enhances our thinking differently, each in a different domain.

But we must remember that many students have capacities that are not academic. There are mechanical capacities, a sense of space and size and the interconnections of parts in a machine and how things work. Such students should have the option of taking a technical program, taught by professionals, in the last two years of high school—assuming of course, that they have completed the academic program mentioned above.

Editor: When and why did we begin to teach these academic subjects?

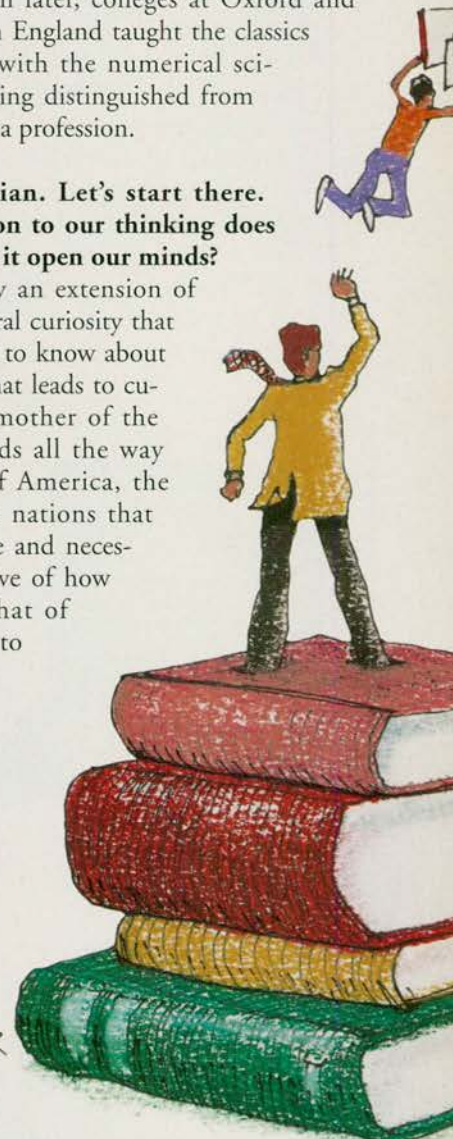
Barzun: The notion of a broad, general education comes to us from the 12th century, when the Cathedral school that was used in the late Middle Ages decided that more ad-

vanced teaching should be available. Later, Jesuit colleges were designed to strengthen Catholic faith in opposition to the Protestant, not by indoctrination alone, but by making well-educated minds. Still later, colleges at Oxford and Cambridge Universities in England taught the classics as liberal arts, together with the numerical sciences—the liberal arts being distinguished from the knowledge needed for a profession.

Editor: You're a historian. Let's start there. What special contribution to our thinking does history make? How does it open our minds?

Barzun: History is really an extension of our lives. We have a natural curiosity that needs to be fed. We want to know about our grandmother—and that leads to curiosity about the grandmother of the grandmother, which leads all the way back to the discovery of America, the character of the western nations that made exploration possible and necessary, in short, the narrative of how our ancestors lived. What of their creations continue to be our daily moral, religious, and intellectual food? Only an animal feels no need of history.

The student who reads history will unconsciously develop what is the highest value of history: judgment in world affairs. This is a permanent good, not because history repeats—we can never



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Opening Minds

Why I Teach



By Patrick Welsh

During my lunch period early last May, I quickly drove from T.C. Williams High School in Alexandria, Va., into downtown Washington, D.C., to drop a package at my wife's office. As I crossed Pennsylvania Avenue and went up 14th Street, I couldn't help but feel sorry for the legions of lawyers, lobbyists, and government workers pouring out of buildings on their way to restaurants. I knew that when my lunch break ended I would be back at school with my sixth-period senior English class discussing a novel I loved, Faulkner's *Light in August*, and I couldn't imagine anyone in the crush on the streets of Washington doing anything more exciting that afternoon.



I was well aware that most of those people would have felt sorry for me had they known that I'd soon be in front of a bunch of high school kids. In fact, whenever I answer the question "What do you do?"—the mantra of social gatherings inside the Washington, D.C., beltway—the reactions I get are not exactly envious. Sometimes, the conversation becomes strained and I get looks that seem to say, "What's wrong with this guy? Can't he find decent work?" At other times, people react not so much with condescension as puzzlement—"You must be brave. How do you do it?" as if teaching today's kids has to be a form of torture.

Of course, for some, teaching is torture. But for those who truly love teaching, the classroom is a place like no other, a place whose magic is deeply felt but hard to articulate. I felt that magic first in the fall of 1965, when I walked into my first class as a teacher—freshman composition at Loyola University in Chicago. All summer I had been dreading it; I felt I just didn't know enough. When I entered the room of some 20 girls and a handful of guys, I was so

nervous that I was sweating and my glasses fogged up. It didn't help matters that a tall blonde girl in the front row whispered, loud enough for everyone to hear, "This guy will be a pushover." After about 10 minutes, I began to relax—and from that moment I knew that the classroom was for me.

About 15 years ago, when I could feel that the kids were getting younger and younger and I was getting older and older, I started to fear that one September I would walk into class and the magic would be gone. I consider myself blessed that this has never happened.

One thing that keeps me coming back is the exhilaration of being with young people—the give and take, the challenge to be on their wavelength and to get them on mine, the being a part, however small, of the lives of the next generation. Maybe playwright Arthur Miller explained it best when, in an essay on *Death of a Salesman*, he wrote that man's greatest need—"a need greater than hunger, or sex, or thirst"—is "to leave a thumbprint somewhere on the world." Years ago, when I first read that remark, I thought to myself, that's it—that's why I teach.

There's a special excitement to teaching in a school like mine where 87 countries are represented in our student body. Over the years, kids from trouble spots all over the world have poured into Alexandria. I have taught kids who escaped from Vietnam on the last flights out of Saigon; kids who have fought in wars in Cambodia and Sierra Leone; kids who walked from El Salvador through Mexico and swam the Rio Grande into Texas. Long before September 11, the cities of Kabul and Kandahar were familiar to my colleagues and me. They were the birthplaces of many of our favorite students. I often wonder if I have taught these kids half as much about literature as they have taught me

(Continued on page 8)

Patrick Welsh is an English teacher at T.C. Williams High School in Alexandria, Va., and a writer. He regularly contributes to national newspapers such as the Washington Post and is on USA Today's board of contributors.



ILLUSTRATED BY ROBERT BARKIN

about the global village we now inhabit.

I'm often asked how I can teach the same thing year after year and not get bored. The answer is that the kids are never the same, so no matter how many times I teach something, the students always make it a new experience.

I agree with the late Ken McCrorie of Western Michigan University who wrote in his book *Twenty Teachers*, that one of the great blind spots with teachers is that "when we walk into our classrooms we forget that we are still human beings." Sometimes I'll see in a flash, usually by accident, how much students look to teachers for counseling and recognition. They look to us for help in getting over a personal crisis. They look for opportunities to display their unique talents. They look for chances to help others. To me, a classroom should become a family—a community where kids want to be and where a great human drama plays out.

Aside from looking forward to the excitement that a new group of students will provide, I think that most teachers get revved up every September because we have a passion for our subject, a belief, however overblown, that we have something to teach that kids cannot live without. When kids see that passion, they respond. I would hate to teach biology, because I find it downright boring. That's not the case with my colleague Dave Keener. "He's just crazy about biology," students say, so much so that they are afraid not to study hard for fear of disappointing him.

I know that the study of biology has saved infinitely more lives than the study of Shakespeare's sonnets. And that physics, chemistry, and math—not the novels of Toni Morrison or Jane Austen—have been the basis of the military might that keeps this country free, but science and math are not "my thing." I am more than content to let others worry about them. For me, literature has infinitely more value than any other subject. Part of that feeling comes from the education I received from nuns and priests in the closed Irish Catholic world in which I grew up in western New York in the '50s. Values and morality, the struggle of good and evil were at the heart of that world—a world I took so seriously that when I was 18, I entered a Jesuit seminary. I left three years later and have seldom darkened the door of a church since; but, as a variation of the cliché goes—you can take the boy out of the seminary, but you can't take the seminary out of the boy.

In his Nobel Prize acceptance speech, Faulkner said that the theme of all great literature is the "human heart in conflict with itself," a theme central to all religions. For me, literature reveals more about our humanity than theology, philosophy, psychology, or history ever can. But it's not just the insight it offers that makes literature, at least for me, superior to all other studies. It is also a matter of its beauty and intensity. The Roman poet Horace said it two thousand years ago when he wrote that the purpose of poetry was not just to teach [*docere*] but also to delight [*placere*]. Shakespeare's plays are still performed all over the world and not just for their insight into human nature or their historical facts. They are staged because Shakespeare's language has a

beauty and his characters a universality that delight us.

At the beginning of the year I always tell my students that I will do my best to choose literature that they will have a chance of "getting into." That may sound like a leftover '60s and '70s "do your own thing, relevancy" cliché, but it's not. I don't know any adults who would put down \$60 to \$80 to see a play that they think they will not enjoy. Nor do any of us go to a bookstore to spend \$25 on a new novel that we feel will bore us. Literature, like any art form, has to speak to us intellectually and emotionally.

In an attempt to show students that literature both teaches and delights, I start the year off with poetry. Compared with novels and plays, poems are compact, intense expressions of ideas and emotions, and by discussing a wide range of poetry the first few weeks, I can get to know my students better and they can get to know me. And if one poem doesn't work, I can quickly try another, whereas with a novel, I could be locked in for a couple of weeks. Poetry, more than any other form of literature, is meant to be felt in the gut. There are few feelings more satisfying than when kids get turned on to a poem—when the truth in it gives them a new insight or confirms something they have always believed or when it evokes a heated discussion.

That's why I always start the year off with poetry that grabs their attention. Denise Levertov's "The Mutes," in which the speaker derides men for sexually harassing women as they walk down the street, never fails to get girls telling boys that they have no idea how rude they are, and boys firing back that girls bring unwanted attention on themselves by dressing provocatively. Richard Wright's "Between the World and Me," an account of coming across the charred body of a lynching victim, stuns many students with its grotesque imagery and shows them that the written word has a power to portray the horror of violence in a way that the mayhem-laden movies they see never can.

Part of the excitement of teaching poetry is forcing kids to wrestle with lines that stump them and then suddenly seeing them light up as they break through to understand what the poet is saying. The ironic religious imagery in Sharon Old's "Sex Without Love" usually throws most kids on first reading, but because it is about one of their favorite subjects, they willingly struggle to break it down. I get even more satisfaction when the poem we are working on comes from a world several hundred years removed from theirs. John Donne's 17th-century metaphysical poetry poses problems for anyone. But when, after lengthy group discussions, poems of Donne like "The Good-morrow" or "The Flea" suddenly bridge some four hundred-plus years and speak to my students, I am reminded again why I love my job.

A novel can lock my students and me in for two or three weeks. That's why the first novels I teach every year are two that always work: J.D. Salinger's *The Catcher in the Rye* and Toni Morrison's *Song of Solomon*. Salinger's Holden Caulfield was created over 55 years ago, but his combination of wit, cynicism, and irreverence, not to mention his boredom with school and difficulties on the dating scene, still resonates with kids today. Morrison's

I think that most teachers get revved up every September because we have a passion for our subject, a belief, however overblown, that we have something to teach that kids cannot live without.



novel, the raw and poignant story of a young man's conflict with and ultimate understanding of his parents and their ancestry, pushes kids who aren't fond of reading to the limit. Its time shifts and use of stream of consciousness—not to mention the fact that it is over four hundred pages long—challenge even the best students. The satisfaction for me is to hear many kids say that difficult though *Song of Solomon* was, they eventually "got into it" and were swept along by the story.

More and more, I consider those moments when I see a poem, novel, or play really speak to kids as enormous victories, because, as much as I still love teaching English, I have no illusions. Like all teachers, I am in an ever-growing battle

for the hearts and minds—indeed just the attention—of teenagers. With instant messenger, e-mail, the Internet, computer games, DVDs, videos, cable TV, and myriad other forms of escape and amusement beckoning, it's harder than ever for kids to curl up with a book, to find the quiet time to concentrate and get in the frame of mind that reading a novel or play requires.

One big victory over the popular culture came last year, when, after my students read Alice Walker's *The Color Purple*, I showed them the film version with Whoopi Goldberg and Oprah Winfrey. There was hardly a student who didn't say the book was infinitely more powerful than the movie. I got the same reaction when, after students read Cormac McCarthy's *All The Pretty Horses*, I showed them scenes from the film version starring Matt Damon and Penelope Cruise. Most kids thought the movie was silly and agreed that it in no way captured the characters and the passion of the novel. They agreed that reading can stimulate the imagination in ways that movies cannot replicate.

Sometimes my victories come when I least expect them. Last year I got up my courage and taught Jane Austen's *Pride and Prejudice* for the first time in some 20 years. While I was confident that the girls would like it, I thought the boys would hate it. But the reaction of Luis Cabrera was almost enough to make my year. Cabrera is a rabid sports fan who seems to know every arcane detail about Washington, D.C.'s sports teams, the Washington Redskins, the Capitals, and D.C. United. He never impressed me as a candidate for the Jane Austen Society, but I was wrong. "Once Darcy came into the picture," Luis said, "I really got into it. He was so cool, the way he handled girls, how he never got pressed about them. I stayed with the book because of him." On the other hand, Luis said he "hated" *The Killer Angels*, the Civil War novel on Gettysburg that I was sure most guys would like. Lee Sparks, however, found *The Killer Angels* deeply moving. "Maybe it was because we read it right after September 11," she said, "but I got this huge feeling of pride and patriotism in reading the book. The nobility on both sides was amazing. Finally I could put faces and personalities on the names that disappear in our history books."

There were few moments more satisfying last year than witnessing the empathy and pure outrage that Elie Weisel's profoundly unsettling Holocaust remembrance, *Night*, evoked from my black American students, as well as from Muslim students from Africa and the Middle East. Several students remarked that Weisel's horrifying recollections of babies being tossed into fire pits, mass hangings, and other atrocities made them rethink their own history. "The book shocked me," says Alton Fortner, now at St. Augustine's College. "It made me see that blacks have not been the only ones to suffer injustice."

Comments like those of Alton and Luis and Lee remind me why, after some 35 years of teaching, I am still excited every year when that first bell rings ushering in the new school year. □

CURING PROVINCIALISM

(Continued from page 6)

exactly match past and present situations—but because the “tendency of things” shows an amazing uniformity within any given civilization. The great historian, Jacob Burckhardt, said of historical knowledge, it is not “to make us more clever the next time, but wiser for all time.”

Plus, a person endowed with the knowledge of history reacts a good deal more serenely and temperately to the things that he encounters both in his own life and in the life of the country in which he lives. Besides which, history is a story—full of colorful and dramatic events and persons, of triumphs and dreadful actions, which must be known in order to form a true notion of humankind.

Editor: What about literature?

Barzun: Literature is another type of story. And everybody loves a story. Literature that consists of something more than striking incidents tells us how life is lived, how it should be lived, how it has been lived in various places in the world and in our own society. Somebody has said very aptly that the novel was invented to teach the young what life is like, and that is exactly true.

The novel is the one form that specifically aims at psychology and sociology, to put it in technical terms. It deals with individual character and with the institutions of society and how the two interact and get into conflict and how those are resolved or not resolved. These mirror the conflicts every student-reader will face. Great literature will help him reflect on them.

There are other forms of literature as well—myth, poetry, drama, biography—which evoke the past, the ethical, the transcendental, and other topics of equal interest.

Literature, then, like history, gets rid of provincialism, of narrowness, of thinking that everything that one does every day is the whole of human existence.

Editor: Can you pick as an example one work of literature for high school students that “deprovincializes”?

Barzun: Let me see. A good American novel.... Well, I don't believe there is any one particular work that should be taught to all high school students everywhere. There are many choices possible.

But, as one example, take a book like Sinclair Lewis' *Main Street*. It covers a good deal of ground depicting the American town, its behavior, and how the city has eliminated the small town ways of life. The alert mind sees at the same time similarity in difference, the familiar amid the strange, while it develops sympathy to balance criticism. This double vision is what cures the bias, prejudice, and bigotry I have called provincialism. Those comparisons, those impressions that evoke sympathy or distaste, are deprovincializing, as you put it.

Editor: You say you're not for having a list of books, an official canon. How do you believe teachers should select literature for their students? What kinds of authors or themes do you think teachers should aim to include?

Barzun: They should, in the first place, choose books that

are well-written and readable and classic, rather than hot off the press. The classic has survived years of criticism and been enjoyed by millions because it deals with more than concerns of the moment. It's critical, of course, that the teachers have read the books and like them. They shouldn't just take works on trust from a prepared list. That is why I am against the list. The chosen book should be from the canon in the big sense, the big canon, but it should be something that the teacher can teach with sympathy and understanding.

Editor: Math?

Barzun: Mathematics speaks for itself: We are surrounded by numbers, swamped by them. We use them to deal with our difficulties—economic, financial, moral, and social. We want to know whether the crime rate is increasing or the divorce rate decreasing. Somebody totally ignorant of any kind of mathematics is an ignoramus, unable to read a certain kind of communication that is continually made in our surroundings and which must be judged as plausible, true, or false. Besides, mathematics trains the mind to observe detail and follow abstraction.

And of course, math is needed for understanding the physical sciences and, just as important, for a possible career in those sciences—not necessarily as a scientist at the top level of discovery, but in many positions throughout the business and governmental world where the command of mathematics is required. High school students should study math at least through advanced algebra and very possibly through calculus.

Editor: Which brings us to science....

Barzun: Science is the ruling intellectual activity of the day and it is the basis of innumerable social conveniences and arrangements. A person should be oriented into that very complicated world by having some notion of physics, biology, and chemistry. As well, perhaps, a bit of geology if the person is interested in nature and how it works. To know nothing about it, to be unaware of the methods of science, to be ignorant of the elementary rules of mechanics and chemical composition is to be incapable of functioning adequately in our society.

Some knowledge of the scientific method as such, apart from particular techniques, also benefits us in our everyday life as we are better able to discuss evidence, verification, correlation, and cause and effect.

Editor: When did these subjects take form? For example, when did science become an independent academic subject?

Barzun: This is a clue: The word scientist was invented in the year 1840 by a philosopher at Cambridge University in England. The date marks his observation that there were now people who were exclusively interested in scientific work. Up to that time, as your question implies, the man doing research in science was also interested in philosophy and religion. He was called a natural philosopher. Newton, for example, was not called a scientist—he was known as a

The alert mind sees at the same time similarity in difference, the familiar amid the strange, while it develops sympathy to balance criticism. This double vision is what cures the bias, prejudice, and bigotry I have called provincialism.

natural philosopher, a philosopher about nature. But, of course, the elements of science go back to Greece, and very possibly to Egypt, so it has been a very gradual growth. When any subject of human concern attains sufficient breadth and depth, it is separated and becomes a professional discipline. By now, the accumulation of knowledge and of rules for increasing knowledge have become so complex that a man interested in adding to it cannot do anything else with the same capacity and chance of success.

But there's something else as well. The steady progress of the scientific elite goes back 400 years, but it was after 1859 that the achievement of the Age of Reason in astronomy, physics, chemistry, and biology were given sudden and violent publicity by the controversy over Darwin's *Origin of Species*.

By 1900, science had conquered its share of the curriculum, won a regular place in the press and the pulpit, and invaded literature and the common tongue.

Editor: And the other subjects?

Barzun: The subjects that we study today were hit upon, were created and declared subjects of study during the last 500 years. The medieval curriculum did have philosophy, theology, and ethics, but it did not have history or sociology or physical science *as such*. It included astronomy and music (deemed a science), as well as mathematics, but it was, of course, of a fairly elementary sort. The astronomy goes back to the Chaldean shepherds from I don't know how many centuries ago—as they made nightly observations. These were accurate and they accumulated. There was a fair conception of astronomy in the Middle Ages. Copernicus

changed a good deal of it, by no means all, and since then it has blossomed into an extraordinary kind of picture of the cosmos.

Literature was not taught as a subject until nearly the end of the 19th century. But the Greek and Roman classics were studied as a kind of conglomerate of history, sociology, economics, biography, morals, ethics, and so forth. The study of English literature did not figure in the curriculum at, say, Oxford or Cambridge until about the 1890s.

Editor: Why did literature suddenly appear at that point?

Barzun: The appreciation of prose literature as something more than entertainment, something very serious which describes and explains human character and human society, began to be seen as needing study because it does not reveal its secrets equally to all minds as soon as it is read. Poetry also became more and more difficult and so it, too, had to be studied. Young people tend to read for the story only, neglecting its implications or significance in the world-at-large.

Even more influential was the desire to be "modern." The scientists wanted room in the curriculum for their disciplines and campaigned against the ancient classics as out-of-date and useless. Studying Greek and Latin took many hours for many years. The humanists gave in to the assault but managed to keep a place for history and literature. Nobody could deny that these subjects threw light on the modern world.

Editor: You say history entered the curriculum more recently.

Barzun: Yes, shortly after the French Revolution, which established the nation as more important than the monarchy. The nation was now regarded as a people with a history, one which was very different from the annals of the Court and the King. These accounts had been published, but they were designed largely for the glorification of the Court itself and few people read them. But with the advent of patriotism and nationalism, the idea that the past of the entire society was important became a matter of course. By the 1830s, almost all the nations of Europe had established national historical societies to gather all the possible documents, records, separate local chronicles, and annals—all of this to create a national history. Then when the national, compulsory public school was established, history naturally became one of the important elements for sustaining a feeling of nationality.

Editor: What about Herodotus and Thucydides? Don't they suggest that history, as a subject, began earlier?

Barzun: They were studied among the other classics but obviously did not offer a modern history with heroes and "lessons" for people who were living 2000 years later in entirely different societies.

Editor: What do young people gain from studying the arts? What's the window on the world that art provides?

Barzun: The first thing, and it's very important not to forget it, is enjoyment. The arts are enjoyable and that is their pri-

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American History

A Drama of Sweep and Majesty

By Wilfred M. McClay

All too many of us who grew up and were educated in the United States were taught, albeit not always consciously, to regard American history as rather thin and provincial gruel, a subject appealing only to intellectually limited people who do not mind forgoing the rich and varied fare of European history. Many a high-school American history course offered by a bored, dry-as-dust pedagogue has reinforced that impression. Such courses tended to offer American history as a cut-and-dried succession of tiresome clichés and factoids, whose importance was, to an adolescent mind, either unclear or self-evidently nugatory: the terms of the Mayflower Compact, the battles between Hamilton and Jefferson, the provisions of the Missouri Compromise, Jackson's Bank War, the origins of "Tippecanoe and Tyler, Too," the Wilmot Proviso, the meaning of "Rum, Romanism, and Rebellion," the difference between the CWA and the WPA and the CCC and the PWA, and so on, and on. Such stupefying courses of study, endless parades of trivia punctuated by red-white-and-blue floats bearing plaster of Paris busts of inspirational bores, are enough to make one suspect that when Henry Ford defined history as "one damn thing after another," he must have had American history specifically in mind.

All this is an enormous shame and profoundly unneces-

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sary. Let me encourage you to sweep away all such narrow preconceptions—and sweep away along with them all narrow filiopietism, and even narrower antifiliopietism, the twin compulsions that so often cripple our thinking about American history—and look at it all afresh. You do not have to decide who you are for and who you are against, who are the heroes and who are the villains. Least of all should you permit the mature study of history to be displaced by Oedipal psychodrama, wherein you symbolically get back at your parents by cheering for the Wobblies and the North Vietnamese (or for the Loyalists and Confederates, as the case may be). Nor, unless you are engaged in a political campaign or ideological crusade—and are, therefore, not really a serious student of American history—need you choose between the red-white-and-blue and anti-red-white-and-blue renditions of the American past.

Instead, you should think of American history as a drama of incomparable sweep and importance, where all the great questions of human existence and human history—the proper means and ends of liberty, individuality, order, democracy, material prosperity, and technology, among others—have converged, been put into play and brought to a high pitch, and are being worked out and fought over and decided and undecided and revised, even as you read this. It is a drama of enormous consequence, with both praiseworthy and execrable aspects, whose outcome even now is far from certain. There is no need to jazz up American history, or dress it up in colorful period costumes, as if it were a subject that is not inherently riveting. On the contrary. The most consequential themes of human history are here in abundance, every single one of them. Whoever is bored with American history is, to paraphrase Dr. Johnson (the 18th-century writer and literary critic), bored with life.



VOTE

WESTBROOK

Let me quickly add that I am not here falling prey to the unfortunate tendency to make the United States into the cynosure of all human history. Indeed, I would contend that part of the problem is that American history tends to be taught and studied in isolation, when in fact it is a subject that can only be properly understood as part of something much larger than itself—and simultaneously as something

much smaller, that insinuates itself into each of our lives. Both these dimensions, the “macro” and “micro” alike, are neglected by our tendency to stick to the flatlands of the middle range. Let us by all means pay our respects to the flatlands. But we should never allow ourselves to be confined to them, lest we lose sight altogether of the inherent sweep and majesty of our subject.

The Different, But Necessary, Truths of History

What is history? One answer might be: It is the science of incommensurable things and unrepeatable events. Which is to say that it is no science at all. We had best be clear about that from the outset. This melancholy truth may be a bitter pill to swallow, especially for those zealous modern sensibilities that crave precision more than they covet accuracy. But the fact of the matter is that human affairs, by their very nature, cannot be made to conform to the scientific method—not, that is, unless they are first divested of their humanness. The scientific method is an admirable thing, when used for certain purposes. You can simultaneously drop a corpse and a sack of potatoes off the Tower of Pisa, and together they will illustrate a precise law of science. But such an experiment will not tell you much about the human life that once animated that plummeting body—its consciousness, its achievements, its failures, its progeny, its loves and hates, its petty anxieties and large presentiments, its moments of grace and transcendence. Physics will not tell you who that person was, or about the world within which he lived. All those things will have been edited out, until only mass and acceleration remain.

By such a calculus our bodies may indeed become indistinguishable from sacks of potatoes. But thankfully that is not the calculus of history. The genuinely interesting historical questions are irreducibly complex, in ways that exactly mirror the irreducible complexity of the human condition. Any author who asserts otherwise should be read skeptically—and, life being short, quickly.

Take, for example, one of the most fascinating of these issues: the question

of what constitutes greatness in a leader. The word “great” itself implies a comparative judgment. But how do we go about making such comparisons intelligently? There are no quantitative units into which we can translate, and no scales upon which we can weigh the leadership quotients of Pericles, Julius Caesar, Genghis Khan, Attila, Elizabeth I, Napoleon, Lincoln, and Stalin. We can and do compare such leaders—or others like them, such as the long succession of American presidents—and learn extremely valuable things in the process. But in doing so, can we detach these leaders from their contexts, and treat them as pure abstractions? Hardly. Otherwise we could not know whom they were leading, where they were going, and what they were up against. If made entirely without context, comparisons are meaningless. But if made entirely within context, comparisons are impossible.

So there is a certain quixotic absurdity built into the very task historians have taken on. History strives, like all serious human thought, for the clarity of abstraction. We would like to make its insights as pure as geometry, and its phrases as effortless as the song warbled by Yeats’s golden bird of Byzantium. But its subject matter—the tangled lives of human beings, in their unique capacity to be both subject and object, cause and effect, active and passive, free and situated—forces us to rule out that goal in advance. Modern historians have sworn off forays into the ultimate. It’s just not part of their job description. Instead, their generalizations are always generalizations of the middle range, carefully hedged about by qualifications and caveats.

This can, and does, degenerate into such an obsession with conscientious

nance that modern historians begin to sound like the J. Alfred Pruffrocks of the intellectual world—self-henpecked, timid, and bloodless, never daring to eat a peach unless they are certain that they’re doing it in proper context. Yet there is something admirable in their modesty. It is the genius of history to be always aware of limits and boundaries.

It is easy for armchair wits to compare Thomas Jefferson and Bill Clinton, or for pundits to rank the American presidents in serial order, or for journalists to pillage the past for anecdotes and easy generalizations about the electoral fortunes of vice presidents and third parties. But it is maddeningly difficult for those who really know their subject, and understand the ever-present contingency and unpredictability of history, to make such judgments, without becoming all knotted up in qualifiers and exceptions.

It is easy to treat the past as if it were an overflowing, open grab bag, and historians are right to admonish those who do so. But only partly right, because man does not live by pedantry and careful contextualization alone. If the study of history is important, then there can be no doubt that it is proper—and necessary—for us to seek out precedents in the past, and to do so energetically and earnestly. Those few precedents are the only clues we have about the likely outcomes for similar endeavors in the present and future.

History, then, is a laboratory of sorts. By the standards of science, it makes for a lousy laboratory. No doubt about that. But the problem is, it is all that we have. It is the only laboratory available to us for assaying the possibil-

American Myths and Narratives

So American history needs to be seen in the context of a larger drama. But there is sharp disagreement over the way we choose to represent that relationship. Is, for example, the nation and culture we call the United States to be understood fundamentally as one built upon the extension of European and especially British laws, institutions, and religious beliefs?

ry and Science

ities of our human nature *in a manner consistent with that nature*. Far from disdain science, we can and should imitate many of the characteristic dispositions of science—the fastidious gathering and sifting of evidence, the effort to be dispassionate and even-handed, the openness to alternative hypotheses and explanations, the caution in propounding sweeping generalizations. Although we will continue to draw upon history's traditional storytelling structure, we also can use sophisticated analytical models to discover patterns and regularities in individual and collective behavior. We even can call what we are doing “social science” rather than history, if we like.

But we cannot follow the path of science much further than that, if only for one stubborn reason: We cannot devise replicable experiments, and still claim to be studying human beings, rather than corpses. It is as simple as that. You cannot experiment upon human beings, at least not on the scale required to make history “scientific,” and at the same time continue to respect their dignity as human beings. To do otherwise is like murdering to dissect. It is not science but history that tells us that this is so. It is not experimental science, but history, that tells us how dreams of a “worker's utopia” gave rise to one of the most corrupt tyrannies of human history, or how civilized, technically competent modern men fashioned the skin of their fellow men into lampshades. These are not experiments that need to be replicated. Instead, they need to be remembered, as pieces of evidence about what civilized men are still capable of doing, and the kinds of political regimes and moral reasonings that seem likely to unleash—or to in-

By relentlessly placing on display the pervasive crookedness of humanity's timber, history reminds us of the grimmer possibilities of human nature.

hibit—such moral horrors.

Thankfully, not all of history's lessons are so gruesome. The history of the United States, for example, provides one reason to hope for the continuing improvement of the human estate, and such sober hopefulness is, I believe, reinforced by an honest encounter with the dark side of that American past. Hope is not real and enduring unless it is based upon the truth, rather than the power of positive thinking. The dark side is always an important part of the truth, just as everything that is solid casts a shadow when placed in the light. Chief among the things history should teach us, especially those of us who live nestled in the comfortable bosom of a prosperous America, is what Henry James called “the imagination of disaster.” The study of history can be sobering and shocking, and morally troubling. One does not have to believe in original sin to do it successfully, but it probably helps. By relentlessly placing on display the pervasive crookedness of humanity's timber, history brings us back to earth; equips us to resist the powerful lure of radical expectations, and reminds us of the grimmer possibilities

Or is it more properly understood as a modern, Enlightenment-based, post-ethnic nation built on acceptance of abstract principles, such as universal individual rights, rather than bonds of shared tradition, race, history, conventions, and language? Or is it a transnational and multicultural “nation of nations” in which a diversity of subnational or super-national sources of identity—race, class, gender, ethnicity,

of human nature—possibilities that, for most people living in most times, have not been the least bit imaginary. With such realizations firmly in hand, we are far better equipped to move forward in the right way.

So we work away in our makeshift laboratory, deducing what we can from the patient examination and comparison of singular examples, each deeply rooted in its singular place and moment. From the perspective of science, this is a crazy way to go about things. It is as if we were reduced to making deductions from the fragmentary journal of a mad scientist who constructed haphazard experiments at random, and never repeated any of them. But that oddness is unavoidable. It indicates how different is the approach to knowledge afforded by the disciplines we call the humanities, among whose number history should be included.

The humanities are notoriously hard to define. But at their core is a determination to understand human things in human terms, without converting or reducing them into something else. Such a determination grounds itself in the phenomenology of the world as we find it, including the thoughts, emotions, imaginings, and memories that have gone to make up our picture of reality. Science tells us that the earth rotates upon its axis while revolving around the sun. But in the domain of the humanities, the sun still also rises and sets, and still establishes in that diurnal rhythm one of the deepest and most universal symbols of all the things that rise and fall, or live and die. There are, in short, different kinds of truth, and we need all of them in order to live.

—WILFRED M. MCCLAY

national origin, sexual practice, etc.—is the main result sought, and only a thin and minimal sense of national culture and obligation is required? Or is it something else again? And what are the implications of each of those propositions for the answers one gives to the question, “What does it mean for me to be an American?” Clearly each understanding will cause one to answer that question in quite a distinctive way.

All three are weighty and consequential notions of American identity. The one thing they have in common is that they seem to preclude the possibility that the United States is “just another nation.” Even nations-of-nations don’t grow on trees. Perhaps you will sniff in this statement the telltale residue of American exceptionalism, the debunkers’ favorite target. Fair enough. But the fact of the matter is that the very concept of “America” has *always* been heavily freighted with large meanings. It even had a place made ready for it in the European

imagination long before Columbus’s actual discovery of a Western Hemisphere. From as early as the works of Homer and Hesiod, which located a blessed land beyond the setting sun, to Thomas More’s *Utopia*, to the fervent dreams of English Puritans seeking Zion in the Massachusetts Bay colony, to the Swedish prairie homesteaders and Scotch-Irish hard-scrabble farmers and frontiersmen, to the Polish and Italian peasants that made the transatlantic voyage west in search of freedom and material promise, to the Asian and Latin American immigrants that have thronged to American shores and borders in recent decades—the mythic sense of America as an asylum, a land of renewal, regeneration, and fresh possibility, has remained remarkably deep and persistent.

Let us put aside, for the moment, whether the nation has consistently lived up to that persistent promise, whether it has ever been exempted from history, or whether any of the other overblown claims attributed to American exceptional-

Windows on American History

Now comes the place where we take a slightly more focused and systematic look at some of the characteristic themes of American history. These are, so to speak, the prime numbers of the field, for they cannot easily be factored down into something more basic—although, to be sure, you will see how readily they link, meld, or overlap. They are also the subjects that one finds weaving in and out of virtually every account, every monograph, and every dissertation and term paper written about the American past. They are the perennial problems of American history. For that reason, as you will see, they often are best expressed not as propositional statements but as questions. For that reason, I have chosen to call them “windows” onto the American past, rather than “sketches” or “portraits” of elements in that past, for they function more as frameworks, orienting our line of vision and directing our inquiry, than they do as endpoints or findings for the inquiry itself. In my book I offer 16 windows on such topics as liberty, pluralism, and religion. Here are three:

The Founding

The United States is distinctive in even having a founding, a clear moment in time in which the nation-state and its institutions were created, in full view

of the world, out in the open air. Americans can look to a real Washington and Madison, rather than a legendary Romulus and Remus, as their forebears. Historians, of course, differ about the meaning of the nation’s beginnings. Was the establishment of the nation’s new constitutional regime really such a dramatic and architectonic moment as the term “founding” implies? Or was it merely a codification into basic law of the shape of an American nation that already existed, and had already been formed decisively by the living legacy of centuries of English law and institutions? Was it truly a founding, in the sense that the principles guiding the Founders and Framers are in some way foundational, permanently necessary for the rest of us, just as the superstructure of a building depends upon its solid foundation? Or was it merely a beginning, the most felicitous deal that could be struck at a given time, opening the way for even more felicitous deals in the years to come? Did it assert a modern idea of politics based upon interest rather than virtue? Or was its modernity tempered and moderated by its simultaneous rootedness in the entire moral and political heritage of the West? And what role did religious conviction and belief in the providential role of America play in the Founding? All of these questions, while a source of endless

academic debate, are of far more than academic importance.

The Frontier

Interestingly, in European parlance, a frontier refers to an inviolable boundary or a no man’s land, often a forbidding and inhospitable place, the edge of something dark and threatening. For Americans, however, the word has a vibrant, almost mystical ring, as the trackless and unsettled territory where civilization renews itself in the quest of exploration by encounter with the unknown and by drinking from the pure springs of unconquered nature. That concept of frontier ran through the literature of the 19th century, but found its classic expression in the 1893 lecture of historian Frederick Jackson Turner, who would immortalize the idea that it was its frontier, not its European heritage, that enabled America to produce a social and political democracy. Turner’s thesis has been disproved and disparaged in a hundred ways, but its mythic quality lives on. Small wonder that President John F. Kennedy called his 1960 campaign platform “the New Frontier,” and referred to the exploration of space as “the last frontier.” Don’t expect this kind of talk to end anytime soon.

Immigration

This is one of the greatest American

ism are empirically sustainable. Instead, we should concede that it is virtually impossible to talk about America for long without talking about the palpable effects of this mythic dimension. As the sociologists say, whatever is believed to be real, even if it is demonstrably false, is real in its social consequences; and so it does one no good to deny the existence and influence of a mythic impulse that asserts itself everywhere.

It should be well understood, too, that this belief in America's exceptional role as a nation has never in the past been restricted to the political Right. Nor is it so restricted today. Consider the following remarks by former Senator Bill Bradley of New Jersey, in a speech he gave on March 9, 2000, announcing his withdrawal from the race for the Democratic presidential nomination:

Abraham Lincoln once wrote that "the cause of liberty must not be surrendered at the end of one or even one hundred defeats."

For Americans, however, the word frontier has a vibrant, almost mystical ring.

themes, not only because the United States is largely a nation of immigrants, but because immigration is such a rich metaphor for the kind of personal transformation that America promises—or compels. It captures both what is wonderful and what is heart-breaking about the American experience. Wonderful, in that it symbolizes America's generosity and openness and promise, as the land of a second chance, where the heavy lumber of the Old World could be put aside. Heart-breaking, in that the price paid for pursuing such aspirations was often so high, not only in the broken and blasted lives of those who failed, but in the poignant loneliness of those who succeeded, only to see their children and grandchildren grow into full-fledged citizens of an alien country, with little or no inkling of a former life.

The question of immigration stirs

the profoundest sentiments. It is hard for some Americans to accept the cultural diversity and the constant cultural upheaval that come with immigration. They fear that unless immigration is carefully controlled, the basic character of the nation may be altered beyond recognition and thereby undermined. For others, it is hard to imagine their country *without* a steady flow of immigrants and the cultural variety it brings. It has ever been thus. The current controversies over rates of immigration and their effects upon the composition of the nation are nothing new; the subject has always been controversial. Such debates do, however, have their significance, since they go to the heart of the open question of whether America is fundamentally a British or a European or a universalistic or a multicultural nation.

What is sometimes lost in the abstract character of these debates, however, and their tendency to focus on aggregate numbers and inchoate abstractions like "diversity," is a simpler meaning of immigration. Emma Lazarus's 1883 poem "The New Colossus," which appears on a bronze plaque at the base of the Statue of Liberty, is perhaps the best expression of it. Just as Emerson's American Scholar disdained the "courtly muses of Europe," so Lazarus's "mighty woman" refused to emulate the "storied pomp" of the

We have been defeated. But the cause for which I ran has not been. The cause of trying to create a new politics in this country, the cause of trying to fulfill our special promise as a nation—that *cannot* be defeated, by one or a hundred defeats.

Senator Bradley was, by all accounts, the more "liberal" of the two Democratic candidates in the 2000 primary season. Yet he found it as comfortable as an old shoe to use this special moment to challenge Americans by speaking the old, old language of "special promise." If that is not a tribute to the persistence of American exceptionalism, then it is hard to imagine what would be.

Almost everyone seems convinced that America, as well as American history, *means* something. To be sure, they don't agree on *what* it means. (Iranian clerics even credit America with being "the Great Satan," a world-historical meaning if there ever was one.) But few permit themselves to doubt *that* American history means something quite distinctive. This

conquering Colossus of Rhodes, preferring a humbler name: "Mother of Exiles." Her joy would not be in luring the powerful and well born, but in embracing the huddled masses and wretched refuse of the earth. To the proud spirit of the Old World she implored: "Send these, the homeless, tempest-tossed, to me." To generations upon generations of the homeless and tempest-tossed—Irish potato farmers, German political refugees, persecuted Russian Jews, Italians, Poles, Greeks, Czechs, Mexicans, Salvadorans, Vietnamese, Cubans, Cambodians, Kosovars—these have not been empty words.

Emma Lazarus came from a sophisticated and refined New York Jewish family. But the sentiments in her poem could have come straight from the biblical prophets and the Christian New Testament—the last shall be first, and the first shall be last; and the stone that was rejected shall become the cornerstone. Such sentiments are an integral part of the warp and woof of American moral life, with its disdain for hereditary privilege, its fondness for underdogs, and its penchant for the second chance. In thinking about immigration, then, we touch upon a subject that engages some of the deepest and most enduring sources of our national soul.

—WILFRED M. MCCLAY

impulse has, of course, given recent American historians much of their subject matter; for wherever there are myths, can the jolly debunker be far behind? The myth of the log cabin, the myth of the self-made man, the myth of the virtuous yeoman farmer, the myth of the Virgin Land—the debunking of these myths and others like them has been the stock-in-trade of our American historians. One sometimes wonders what they would be doing with their time were there not such tempting myths to explode.

But one will likely wonder to no purpose, because the chances are exceedingly slim that they will ever find themselves in that predicament. Americans seem disinclined to stop searching for a broad, expansive, mythic way to define their national distinctiveness. They have been remarkably productive at this in the past. Consider the following incomplete list of conceptions, many of which may already be familiar to you, and most of which are still in circulation in one form or another:

- The City Upon a Hill: America as moral exemplar
- The Empire of Reason: America as the land of the Enlightenment
- Nature's Nation: America as a nation uniquely in harmony with nature
- *Novus Ordo Seclorum*: America as the new order of the ages
- Redeemer Nation: America as redeemer of a corrupted world
- The New Eden: America as land of newness and moral renewal
- The Nation Dedicated to a Proposition: America as land of equality
- The Melting Pot: America as blender and transcender of ethnicities
- Land of Opportunity: America as the nation of material promise and social mobility
- The Nation of Immigrants: America as a magnet for immigrants
- The New Israel: America as God's new chosen nation
- The Nation of Nations: America as a transnational container for diverse national identities
- The First New Nation: America as the first consciously wrought modern nation
- The Indispensable Nation: America as a guarantor of world peace, stability, and freedom

In addition to these formulations, there are other, somewhat more diffuse expressions of the national meaning. One of the most pervasive is the idea of America as an *experiment*. This concept of the national destiny was used by none other than George Washington, in his first presidential inaugural address, to denote two things: first, a self-conscious effort to establish a well-ordered, constitutional democratic republic, and second, the contingency and chanciness of it all, the fact that it might, after all, fail if our efforts do not succeed in upholding it. But the idea of the national experiment has, over time, lost its specific grounding in the particulars of the American Founding, and has evolved into something entirely different: an ideal of constant openness to change. "Experimental America" has a tradition, so to speak, but it is a tradition of traditionlessness. In this acceptance,

America-as-an-experiment is a pseudoscientific way of saying that none of the premises of our social life are secure: everything is revocable, and everything is up for grabs. One can call this dynamism. One can also call it prodigality.

In any event, none of these mythic constructs enjoys anything like unquestioned predominance in American consciousness. But none is entirely dead either, and some are very much alive. They all work upon, and complicate, the sense of national identity. That there will be more such characterizations devised in years to come seems certain. And that they will give rise to debunking opposition seems just as inevitable. Americans' firm belief that they are distinctive would appear to support a perpetual industry. But my principal point is that such a firm belief is *itself* a datum of great importance, even if debunking historians can prove—Pyrrhic triumph!—that there is not a shred of truth to it. That Americans believe in, and search for the evidence of, their special national destiny is simply a fact of American history. By the 20th century it had become a fact of world history. The European view of America continued, as it always has, to have a strong element of projection, melding idealization and demonization: America is a vibrant land of innovation, freedom, and possibility, paired with America as an unsettled land of geopolitical arrogance, neurotic restlessness, manic consumerism, and social disorder. For East Asian observers, America the land of individual liberty and dynamism comes in tandem with America the land of intolerable social indiscipline.

That said, however, one has to acknowledge that the sheer number of these mythic versions of America tends to undermine their credibility—just as, when there are too many religions in circulation, all of them begin to look implausible. And so there can be no doubt that, while the desire to discover national meaning continues unabated, the story of American history as told today does not have the same kind of salient and compelling narrative energy that it had 50 or 100 years ago. Perhaps the myths are too exalted, too inflated, to live by, without egregious hypocrisy or overreaching. In any event, we have, in some measure, lost our guiding national narrative—not completely, but certainly we have lost it as a near-universal article of faith. There is too much self-conscious doubt, too little confidence that the nation-state itself is as worthy of our devotion as is our subgroup. Indeed, the rise of interest in more particularist considerations of race, class, gender, sexuality, ethnicity, religion, and so on have had the effect of draining energy away from the national story, rendering it either weak and indecisive—or the villain in a thousand stories of "subaltern" oppression.

The problem is not that such stories do not deserve to be told. Of course they do. There is always a horrific price to be paid in consolidating a nation, and one is obliged to tell the whole story if one is to count the cost fully. The brutal displacement of Indian tribes, the horrors of chattel slavery and post-emancipatory peonage, the grim conditions of industrial labor, the ongoing tragedy of racial and religious hatred, the hidden injuries of class—all these stories and others like them need to be told and heard, again and again. They should not, however, be told in a way that sentimentalizes

You should think of American history as a drama of incomparable sweep and importance, where all the great questions of human existence and human history—the proper means and ends of liberty, individuality, order, democracy, material prosperity, and technology, among others—have converged.

very well, for example, to be disdainful of corporate capitalism, or postwar suburbia, or any of the other obligatory targets. But the criticism will lack weight and force unless the standard against which corporate capitalism is measured is historically plausible rather than utopian. One can always imagine something better than what is. But the question is: Are there any real historical instances of those alternatives? And what hidden price was paid for *them*? That is the kind of thinking that historians are obliged to engage in.

It is not the content of these more particular stories that constitutes the problem for our dissolving national narrative. It is the fact that the push to tell them, and feature them, has been too successful. The story of American history has been deconstructed into a thousand pieces, a development that has been reinforced and furthered by both professional and ideological motives, but one that is likely in due course to have untoward public effects. Which raises an interesting question: Since throughout history strong and cohesive nations generally have had strong and cohesive historical narratives, how long can we continue to do without one? Do our historians now have an obligation to help us recover one—one, that is, that amounts to something more than a bland-to-menacing general background against which the struggles of smaller groups can be highlighted? Or are the scholarly obligations of historians fundamentally at odds with any public role they might take on, particularly one so prominent? Such a conundrum is not easily resolved. One should, however, at least acknowledge that it exists.

* * *

To understand the history of one's own country, even when one feels oneself to be more or less detached from it, is to gain insight into who one is, and into some of the basic elements of one's makeup. At a minimum, this will result in a rewarding sense of rich historical background that serves to frame and amplify one's own experience—as when one comes to absorb and mentally organize the history of the streets and buildings and neighborhoods of one's city or town. Then even the most routine street scenes reverberate in our consciousness with invisible meanings, intimations that flicker back and forth, again and again, between what we see and what we know.

In the presence of great historical sites, such as the Gettysburg or Antietam battlefields, such awareness takes an even deeper hold of our imaginations and emotions. It is like the sweet melancholy of a solo violin, whose haunting voice pierces us, through all the layers of rationality, with the keen edge of loss. There is a continuity of sorts between such profound emotions and the mingled thoughts and feelings that arise in us when we revisit one of the long-forgotten places of our childhood, or mark the gravestone of someone we have lost. Man is in love, said Yeats, and loves what vanishes. Such is the painful beauty of historical awareness. Our efforts to connect with the vanished past do not necessarily make us happier in any simple sense. But they make us more fully human, and more fully at home in the world, in time as well as space. We fail to honor our full humanity when we neglect them. □



them, by displacing the mythic dimension of the American story onto them, and by ignoring the pervasive existence of precisely such horrors and worse in all human societies throughout recorded time. History is not reducible to a simple morality play, and it rarely obliges our moral aspirations in anything but rough form. The crimes, cruelties, inequities, and other misdeeds of American history are real. But they need to be weighed on the scale of *all* human history, if their relative gravity is to be rightly assessed. It is all

The Whole Shebang

How Science Produced The Big Bang Model

By Timothy Ferris

The empirical spirit on which the Western democratic societies were founded is currently under attack, and not just by such traditional adversaries as religious fundamentalists and devotees of the occult. Serious scholars claim that there is no such thing as progress and assert that science is but a collection of opinions, as socially conditioned as the weathervane world of Paris couture. Far too many students accept the easy belief that they need not bother learning much science, since a revolution will soon disprove all that is currently accepted anyway. In such a climate it may be worth affirming that science really is progressive and cumulative, and that well-established theories, though they may turn out to be subsets of larger and farther-reaching ones—as happened when Newtonian mechanics was incorporated by Einstein into general relativity—are seldom proved wrong. As the physicist Steven Weinberg writes, “One can imagine a category of experiments that *refute* well-accepted theories, theories that have become part of the standard consensus of physics. *Under this category I can find no examples whatever in the past one hundred years.*” Sci-

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ence is not perfect, but neither is it just one more sounding board for human folly.

Nor is science a static body of dogma, to stray from which is to risk having one's epaulets stripped off in a ceremony of banishment from the scientific community. It is a self-correcting system of inquiry, in which errors—of which there are, of course, plenty—are sooner or later detected by experiment or by more careful analysis. Science is also a “bottom-up” system, in which grand pronouncements are arrived at not in an overarching, *sui generis* fashion but by building up inferences from many small cases. As a result, science, while it can be exasperatingly detailed, is also pliant. Scientific findings, even the most imposing ones, customarily stumble into the world fraught with blunders that have to be worked out before they really begin to fly. They lack the satisfying, thunderclap certitude of religious and pseudoscientific dicta that admit to no error. But they are alive, and the withering of one branch of a theory does not mean that the theory as a whole is doomed.

* * *

Cosmology today is mostly conducted within the broad framework of what is known as the “standard” or “big bang” model. It holds that the universe began in a state of high density, from which it has since expanded and cooled. For reasons I will explain, I expect this standard model to endure. This position may seem curious to readers of the many newspaper and magazine articles that have appeared during the past decade proclaiming that this or that observational finding has put the big bang theory in jeopardy. Such accounts seem to me to result from a misunderstanding of science generally and of the big bang theory in particular. My purpose in this article is to summarize the main reasons that many scientists feel confident about the



standard big bang model of the universe. Admittedly, the model is far from complete. Scientists don't yet know exactly how old the universe is, how big it is, how rapidly it expands, how much matter is in it, or from where it came. (As the English astronomer royal, Martin Rees, remarks, "It's embarrassing that 90 percent of the universe is unaccounted for.") Nor is it clear how the matter we *do* see organized itself into stars and galaxies. There are a great many things we do not know. But it is quite possible that all these issues will be resolved, one way or another, without leaving the basic precepts of the standard model behind.

A Picture of the Universe Develops

How did science arrive at its present understanding of the age, scale, and evolution of the universe?

Here's the story so far:

The ancient Greeks thought that the earth (which they understood to be a sphere) sat immobile at the center of the universe, orbited by concentric crystalline spheres to which were attached the sun, moon, planets, and stars. This model answered well to common sense: The stars do appear to circle the earth daily, while to advocate the alternative proposal—that this effect is produced by a rotation of the earth rather than of the starry sphere—was to encounter objections that were insurmountable at the time. (If the earth is spinning, why does a man who jumps straight up land in his footprints, rather than hundreds of yards to the west?) The geocentric cosmos was also aesthetically pleasing: It portrayed our world as a sphere set at the center of a nested set of spheres, a conception that resonated with Plato's conviction that the sphere is the most perfect of all geometric shapes, since it confines the largest possible volume within a given surface area.

This model was put together by two of the keenest minds of the fourth century B.C., the philosopher Aristotle and the astronomer Eudoxus, and it won widespread acceptance. But the Greeks were not content with simply admiring its splendors. They also expected the theory to account for the data of observation—to explain motions seen in the sky in the past and to predict those coming up in the future, especially such spectacular events as eclipses of the sun and moon and conjunctions of the planets. It is for this reason more than any other that we celebrate the Greeks as the precursors of modern science. Their skepticism set in motion the questioning, subversive, and perpetually dissatisfied spirit that is characteristic of science. The ultimate failure of their model proffers a cautionary lesson as well—that in cosmology a theory can be sensible and beautiful and also quite wrong. The geocentric cosmology of Aristotle and Eudoxus did not, in the long run, generate accurate predictions of the motions of the planets.

Ptolemy and Copernicus Advance Our Thinking

Better results were obtained by the more complicated model composed in the second century A.D. by Ptolemy at Alexandria. In the Ptolemaic universe each planet orbited in an epicycle—a small circle—centered on a point in its orbit around the earth, or even on a point in another epicycle. This was clever but highly abstract; Ptolemy himself viewed

his model as merely a mathematical expedient. And it was so complicated that Ptolemy's name became a lasting epithet for theories regarded as unduly elaborate or insufficiently physical. Nevertheless the Ptolemaic universe reigned in the West for fourteen hundred years, until it was challenged by Copernicus.

Schoolchildren today are still being taught that the sun-centered Copernican universe brought simplicity and light to cosmology in a single stroke. But the Copernican model in its original form was neither less complicated than Ptolemy's nor more accurate. Copernicus assumed that the orbits of the planets are circular; consequently he too had to resort to epicycles. Copernicanism was favored by some astronomers, particularly younger scholars of a radical bent, not because it solved all their problems but because, by demonstrating that a heliocentric cosmology could compete with Ptolemy's geocentric one, it opened up fresh opportunities for original thought. The prospects were enormous—literally so. The Ptolemaic universe was inherently small: The sphere of stars that enclosed it had to spin once around the earth every day, and if the starry sphere was very big it would have to rotate at such tremendous speed that it might fly apart. But if Copernicus was right, then the very fact that the stars remain in the same place in the sky while the earth moves through its orbit, thereby altering its perspective on the stars, means that the stars must be far away. In this way the Copernican proposal threw back the walls surrounding the solar system, opening up a vast universe beyond.

But the Copernican model was afflicted by two major problems. Since it portrayed the planets as orbiting the sun in perfect circles, it was driven toward complexity and error. Planetary orbits are not circular but elliptical. Trying to predicate planetary motions on circular orbits is like trying to learn how a football bounces by bouncing a basketball. And since physics had not advanced much since the time of the Greeks, advocates of any geocentric model were still stumped by the old objections: If the earth rotates, why *don't* jumpers land to the west of their starting point and howling easterly winds constantly rake the surface of the planet, especially at the equator, where everything is moving east at a velocity of 1,000 miles an hour?

It fell to two of the leading scholars of the Renaissance to address these problems by correcting flaws in the Copernican cosmology and marrying it to terrestrial physics. Johannes Kepler and Galileo Galilei were both talented writers whose books carried their ideas into the mainstream of intellectual discourse throughout the literate world. Otherwise they were quite different men, one theoretical and solitary, the other experimental and more gregarious.

Kepler Corrects Copernicus

To appreciate the beauty of a scientific law is for most of us an acquired taste, like drinking Scotch or enjoying the music of Alban Berg. And as few become sensitized to science during their formative years, it may well be that connoisseurs of scientific aesthetics are even scarcer than drinkers of MacCallan whisky or devotees of *Wozzeck*. But for those who want to learn how to value science for its beauty as well as for its accuracy, Kepler's laws are a good place to start.

The Copernican proposal threw back the walls surrounding the solar system, opening up a vast universe beyond.

The first law reveals that the orbits of the planets describe, not perfect circles, but ellipses (i.e., ovals), with the sun located at one focus of each ellipse. This masterful demonstration prompted Immanuel Kant to call Kepler the most acute thinker ever born. Like every other cosmologist up to that time, Kepler had assumed that the planetary orbits must be circular. To arrive at the elliptical hypothesis, therefore, he was required to set aside a fundamental aspect of his own intellectual architecture and that of the society to which he belonged. Upon learning of this bold step, his contemporaries reacted with dismay, criticizing not only his hypothesis but his method, which involved intensive application of more sophisticated mathematics than any astronomer of the day employed. Even his old astronomy professor disapproved. (This was Magister Michael Maestlin, who had introduced Kepler to Copernican cosmology and whom Kepler revered.) Kepler's accomplishment was all the more remarkable in that, by the time he resorted to ellipses, he had already earned an estimable reputation and was pushing 40 years of age, conditions not normally conducive to mathematical innovation. "I have spent so much pains on it that I could have died 10 times," he wrote. The effect was, he recalled, like awakening from sleep to see the light.

The elegance of the first law was not immediately apparent to casual observers, who wondered what difference it made whether planets moved in circles or in rotund ellipses that at a glance did not look all that different from circles. The aesthetic force of Kepler's discoveries emerges more clearly in the second law. It shows that the orbital velocity of each planet increases when it is near the sun and decreases when far away, at just such a rate that the area swept out within its orbit is equal during equal intervals of time. In other words, if one charts the motion of Mars over a period of one month when it is far from the sun, and draws a long, thin triangle connecting the sun with the planet's position at the beginning and end of that month, then draws a fatter triangle inscribing Mars's monthly motion when it is closer to the sun, the areas of the two triangles are equal. The same is true of any orbiting object. This subtle symmetry thrilled Kepler, who compared it to the harmony of contrapuntal music.

Kepler's third law declares that the cube of the semimajor

axis (half the long axis) of each planet's orbit is proportional to the square of the planet's orbital period. The third law provided astronomers with a capable tool for mapping the solar system, since it meant that if they knew how long it took a planet to go around the sun—information already available when Kepler was alive—they could deduce the size of its orbit relative to those of the other planets. To measure the actual size of any one planetary orbit is, therefore, to have learned the actual sizes of all the other orbits. Similarly, when one examines planets like Jupiter or Saturn that have many *satellites* (a word coined by Kepler), measuring the size of one's satellite orbit yields the sizes of the other orbits.

While Kepler was doing all this, Galileo was repairing some of the deficiencies in the physics of the Copernican theory. Both Kepler and Galileo were revolutionaries who had managed to shake off the ancient belief that pure thinking is superior to the awkward and often messy business of rolling balls down inclined planes, squinting through primitive telescopes, and otherwise interrogating the material world. Albert Einstein wrote encomiums in their honor, stressing their willingness to look for truth in nature, thus overcoming their culture's traditional preference for abstract thought over empirical observation. Kepler, Einstein noted, "had to recognize that even the most lucidly logical mathematical theory was of itself no guarantee of truth, becoming meaningless unless it was checked against the most exacting observations in natural science." Of Galileo he said: "Pure logical thinking cannot yield us any knowledge of the empirical world; all knowledge of reality starts from experience and ends in it. Propositions arrived at by purely logical means are completely empty as regards reality. Because Galileo saw this, and particularly because he drummed it into the scientific world, he is the father of modern physics—indeed, of modern science altogether."

Galileo Explains Why Jumpers Don't Fly Westward

Galileo's most significant contribution to the physics of cosmology came with his insight into the concept of inertia. Aristotle had assumed, and the Western world had come to believe, that the natural tendency of objects is to remain at rest. This certainly seems to accord with experience—a book or a boulder stays in one place unless one expends energy in moving it—and even today the word *inertia* is commonly taken to mean sluggishness or stasis. Galileo saw that this commonsense assumption was wrong. He pushed wood blocks across a tabletop, then polished the table and the blocks and pushed the blocks again, and pondered the significance of the fact that when there was less friction they traveled farther. He reasoned that if they could be polished perfectly, so that there was *no* friction, they would keep moving forever. Inertia, he concluded, is not just a tendency of bodies at rest to remain at rest, but also of bodies in motion to remain in motion.

Galileo's counterintuitive insight resolved the basic objection to the Copernican assertion that the earth moves. Jumpers don't fly westward nor do easterly gales constantly

(Continued on page 43)

Visions of Wisdom

Like other disciplines, art serves man's endless urge to understand and explain himself, his place in the universe, and his place in society. From prehistoric cave paintings to today, art has captured, honored, and passed on the knowledge, values, and historical events our societies have revered. As such, art is a lens that enables us to see how different people, ideas, and activities have been celebrated in different societies at different times. Representing works of art from ancient to modern times, from Asia to Africa to America, the pieces in this art essay pay tribute to wisdom, teaching, and learning.

School of Athens

Raphael's "School of Athens" is one of a series of frescoes that represent the four areas of learning honored during the High Renaissance—theology, philosophy, law, and art—and Renaissance efforts to reconcile the religious and secular. At the center of this piece are Plato (pointing to the heavens to indicate his belief in absolute good coming from God) and Aristotle (pointing to the earth to indicate his dedication to what can be learned from the material world). Gathered around are famous Greek philosophers including Socrates, the mathematicians Euclid and Pythagoras, and the scientist Ptolemy.

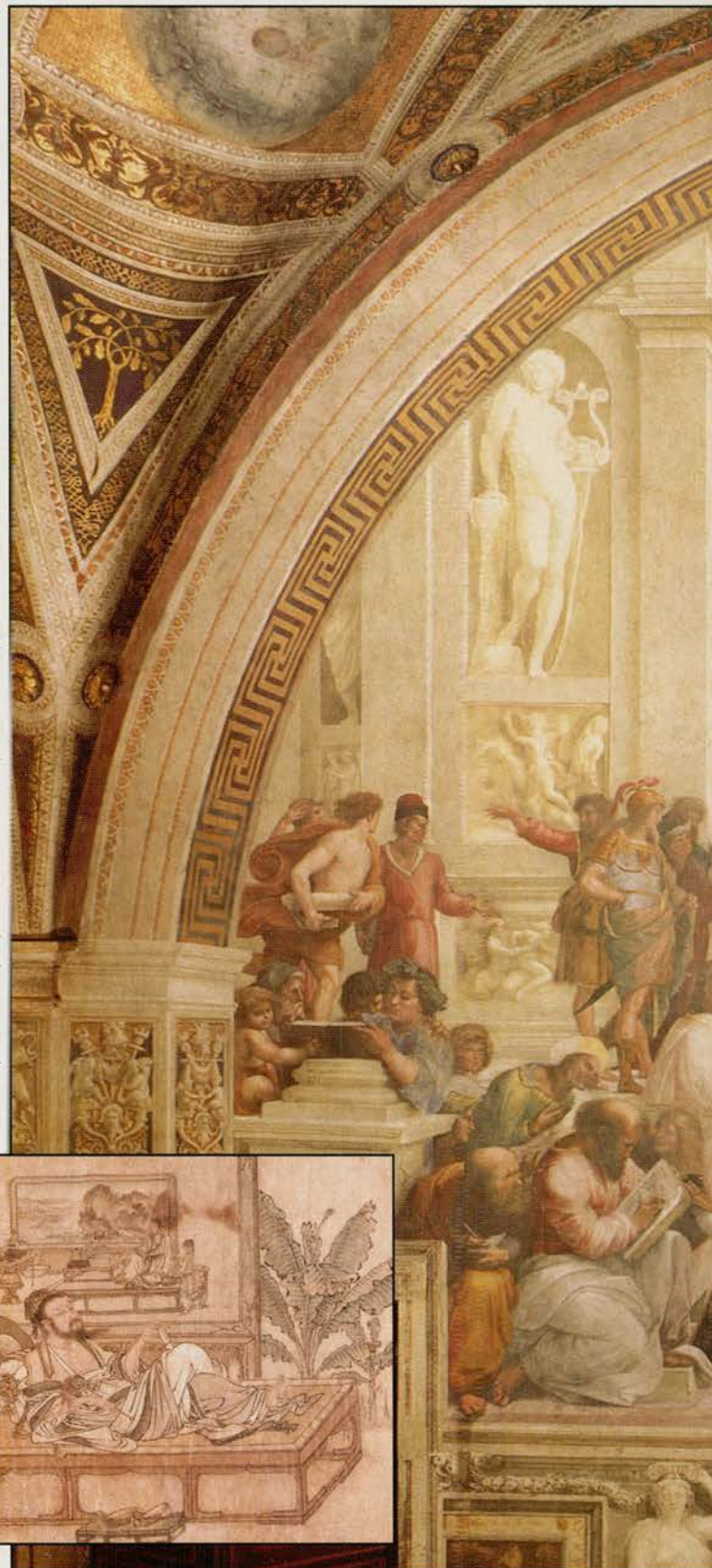
Alexander Approaches the Circle of Plato and the Philosophers

Alexander the Great (356–323 B.C.) brought Plato's ideas to the lands he ruled, including much of Asia. The inset above, an illustration from the Persian poet Nizami's "The Romance of Alexander the Great," commemorates Alexander's apprenticeship under the great Greek sages.

Whiling Away the Summer

Created while China was under the rule of the foreign Mongols, this detail from a 13th-century silk handscroll by Liu Guandao (inset, right) honors the ideal Chinese scholar. With its images of ceramics, bronze, and a musical instrument, it reflects the period's strong interest in protecting traditional forms of Chinese learning from Mongol influence.

Special thanks to Lynn-Steven Engelke, teacher services manager at the Smithsonian Center for Education and Museum Studies, for assisting American Educator in developing this article. As the central office of education of the Smithsonian—the world's largest museum and research complex—the Center connects teachers with the Institution's resources through its educational programs, publications, and Web sites.



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THE NELSON-ATKINS MUSEUM OF ART, KANSAS CITY, MISSOURI



AN ILLUSTRATION FROM
A KHAMSAH OF NIZAMI,
FEER GALLERY OF ART,
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Art Honors the Wise...



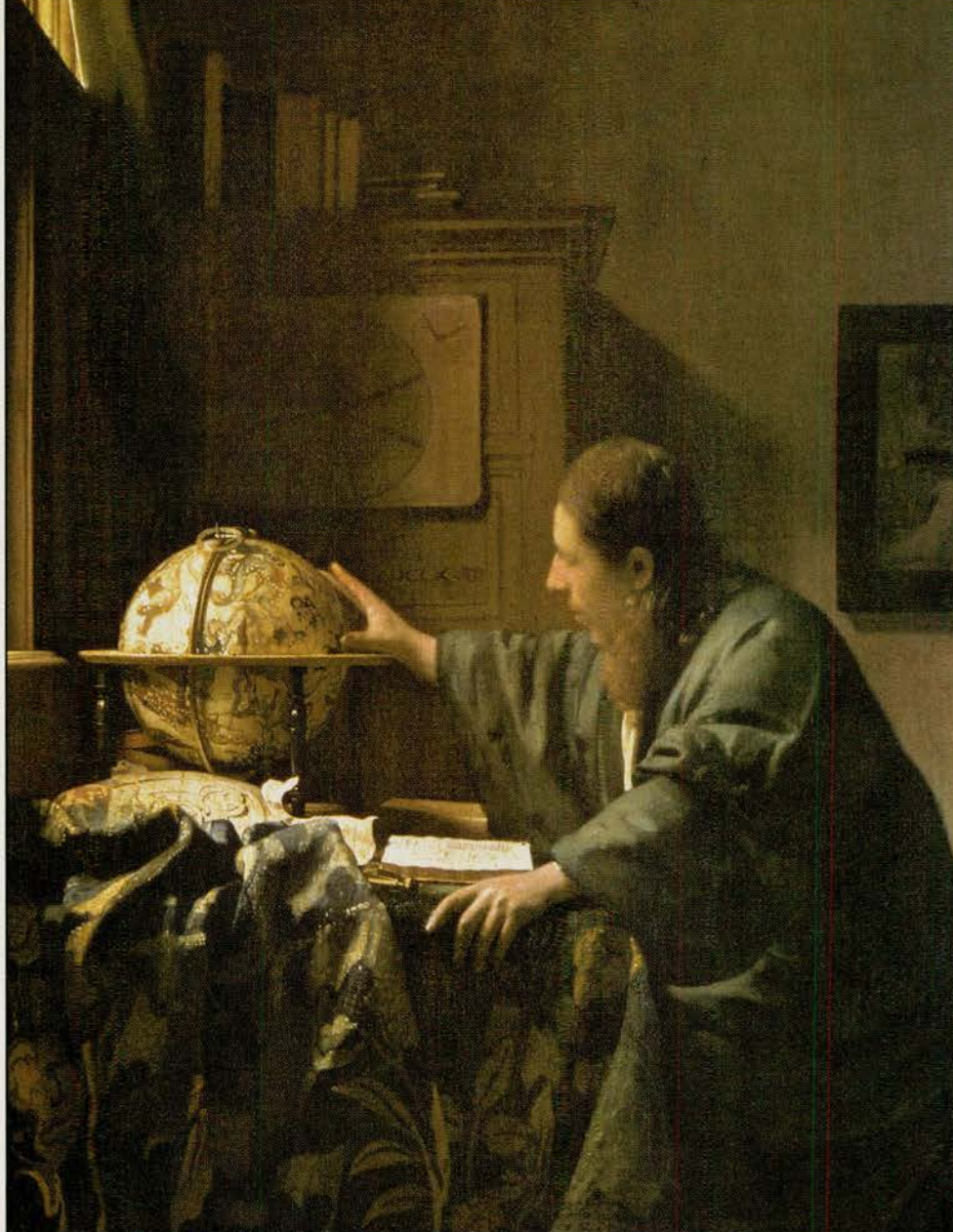
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Confucius

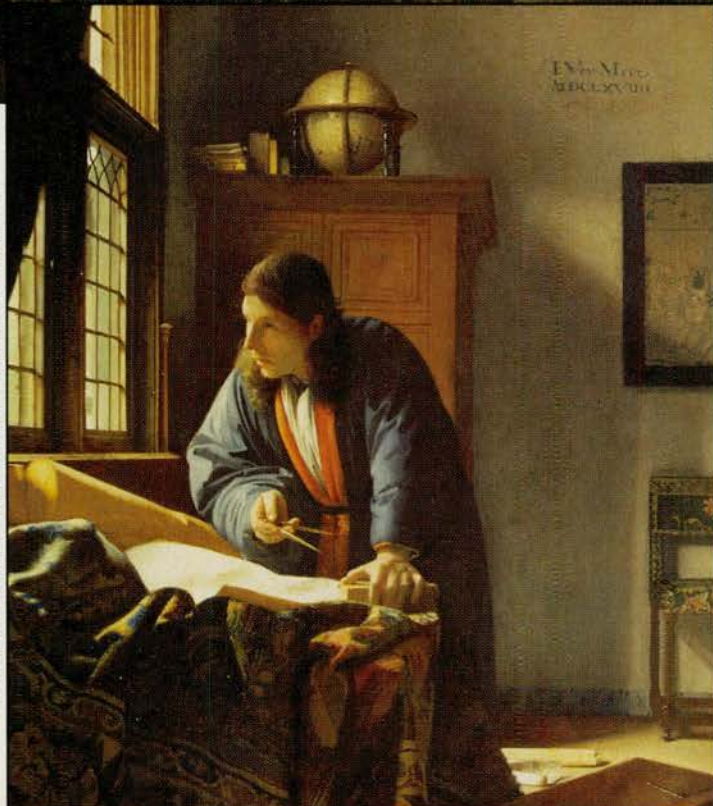
Now renowned worldwide as a great scholar, Confucius is honored in this mosaic from the James Harmon Hoose Library of Philosophy at the University of Southern California. It highlights the Confucian saying: "He who knoweth the truth is not as good as he who loveth it: and he who loveth it is not as good as he who delighteth in it."

The Astronomer and The Geographer

Jan Vermeer's 17th-century paintings pay tribute to the vital knowledge of the day—the studies of the earth and the heavens—on which Dutch advances in navigation, and therefore their riches, were dependent.



REUNION DES MUSEES NATIONAUX/ART RESOURCE, NY



BLAUJEL/GNAMM/ART/TOHEK, COURTESY STAEDTISCHES KUNSTINSTITUT, FRANKFURT



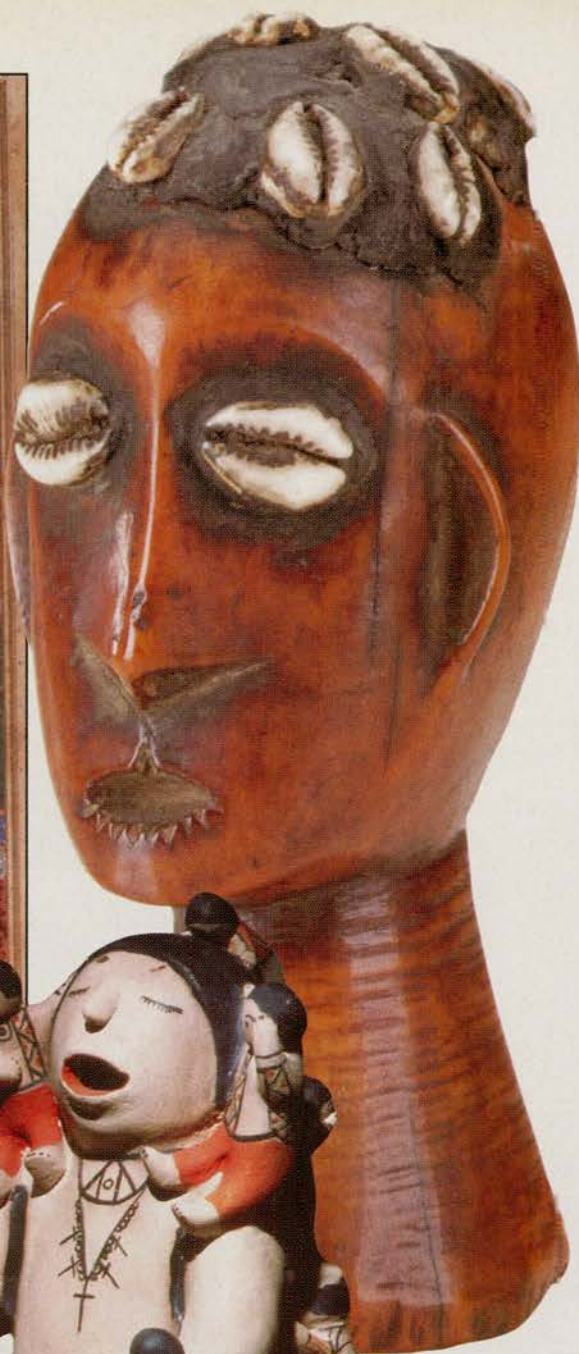
Muslim Astronomers

With astronomers conferring around an astrolabe (a medieval instrument used to determine the altitude of the sun, stars, and planets), this painting reveres Muslim scholars' great advances in science. Between the 9th and 11th centuries, Muslims combined their knowledge of geometry and astronomy to greatly improve on the early Greek astrolabes. By pairing their newer versions with star maps, the Muslims were able to determine latitude, time, and even the thickness of Earth's atmosphere.

Storyteller

By memorizing and telling amusing and thought-provoking stories, Native American storytellers preserved and passed on the group's collective knowledge, ensuring that their religious beliefs, understandings of plants and animals, and practical life skills would be transmitted to the younger generations.

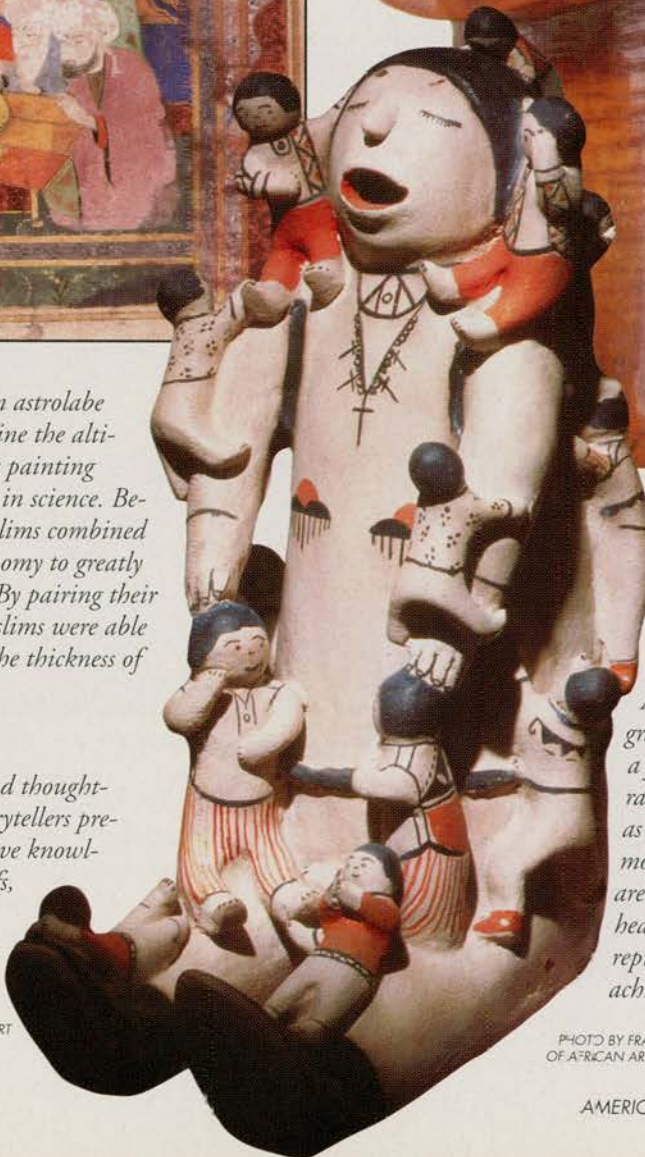
GIRARD COLLECTION/THE MUSEUM OF INTERNATIONAL FOLK ART (UNIT OF THE MUSEUM OF NEW MEXICO, SANTA FE, N.M.), PHOTOS BY MICHEL MONTEAUX



Ivory Head from the Bwami Association

The Bwami association is a system of governance and education developed by the Lega peoples of central Africa. Through Bwami, a graded association in which just a few elders reach the highest rank, essential Lega values, such as respect, moderation, and moral and physical perfection, are taught. This smooth, ivory head covered with cowrie shells represents a Bwami elder who has achieved supreme wisdom.

PHOTO BY FRANKO KHOURY/NATIONAL MUSEUM OF AFRICAN ART, SMITHSONIAN INSTITUTION



...and the Content and Joy of Teaching and Learning

Agnew Clinic

An homage to medical knowledge, this painting (right) shows Dr. David Hayes Agnew, professor of surgery at the University of Pennsylvania from 1870 to 1899, lecturing medical students on a just-completed operation.

The Four Accomplishments

In the traditional Japanese iemoto education system, students' accomplishments in flower arranging, tea ceremony practices, classical music, and calligraphy preserve the philosophy and skills of the master. Equally valued are the reciprocal relationships between and among students and teacher. A frequent expression is that "the teacher is often taught."



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ONE OF A PAIR OF SCROLLS BY TOYOCHIRO UTAGAWA / FREER GALLERY OF ART, SMITHSONIAN INSTITUTION



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Galileo Demonstrating the Telescope to the Senate of Venice

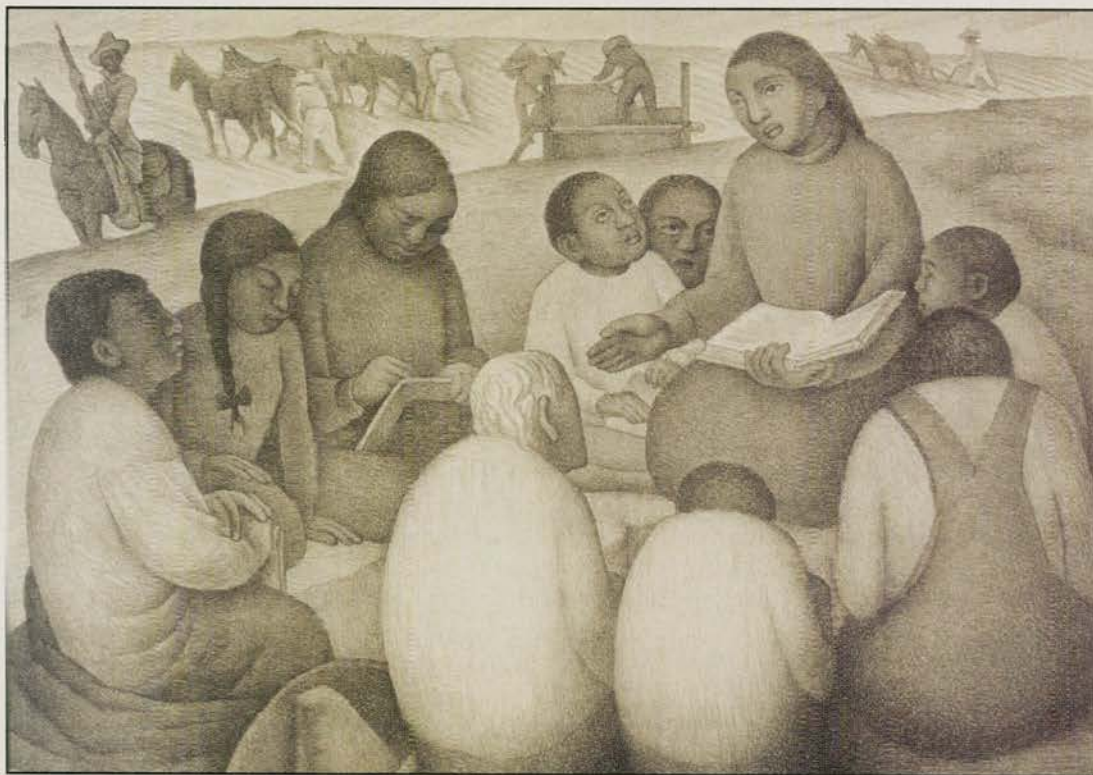
In August 1609, Galileo presented his eight-powered telescope to the Venetian Senate. Within a few months Galileo developed a 20-powered telescope, an instrument powerful enough for him to discover four satellites of Jupiter.

Open Air School

This lithograph by Diego Rivera (right) captures the heart of schooling—a learned adult happily working with a group of children. The migrant workers and the armed horseman in the background remind us of the social context of education and the special importance of learning for these children and their society.



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The Library
In this reading room filled with African-American readers, Jacob Lawrence (above) recalls his Harlem childhood, the love of books he developed in the local library, and the commitment to nurturing young minds that he found there. This 1960 painting also looks to the future. The young readers are absorbed in these illustration-filled books that connect intimately with their lives and aspirations.

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A Community of Saints

Huckleberry Finn: 1948

By Lionel Trilling

In 1876 Mark Twain published *The Adventures of Tom Sawyer* and in the same year began what he called “another boys’ book.” He set little store by the new venture and said that he had undertaken it “more to be at work than anything else.” His heart was not in it—“I like it only tolerably well as far as I have got,” he said, “and may possibly pigeonhole or burn the MS when it is done.” He pigeonholed it long before it was done and for as much as four years. In 1880 he took it out and carried it forward a little, only to abandon it again. He had a theory of unconscious composition and believed that a book must write itself; the book, which he referred to as “Huck Finn’s Autobiography,” refused to do the job of its own creation and he would not coerce it.

But then in the summer of 1882 Mark Twain was possessed by a charge of literary energy which, as he wrote to Howells,* was more intense than any he had experienced for many years. He worked all day and every day, and periodically he so fatigued himself that he had to recruit his strength by a day or two of smoking and reading in bed. It is impossible not to suppose that this great creative drive was connected with—was perhaps the direct result of—the visit to the Mississippi he had made earlier in the year, the trip which forms the matter of the second part of *Life on the Mississippi*. His boyhood and youth on the river he so profoundly loved had been at once the happiest and most significant part of Mark Twain’s life; his return to it in middle age stirred memories which revived and refreshed the idea of *Huckleberry Finn*. Now at last the book was not only ready but eager to write itself. But it was not to receive much conscious help from its author. He was always full of secondary literary schemes and now, in the early weeks of the sum-

mer, with *Huckleberry Finn* waiting to complete itself, he turned his hot energy upon several of these sorry projects, the completion of which gave him as much sense of satisfying productivity as did his eventual absorption in *Huckleberry Finn*.

When at last *Huckleberry Finn* was completed and published and widely loved, Mark Twain became somewhat aware of what he had accomplished with the book that had been begun as journeywork and depreciated, postponed, threatened with destruction. It is his masterpiece, and perhaps he learned to know that. But he could scarcely have estimated it for what it is, one of the world’s great books and one of the central documents of American culture.

Wherein does its greatness lie? Primarily in its power of telling the truth. An awareness of this quality as it exists in *Tom Sawyer* once led Mark Twain to say of the earlier work that “it is *not* a boys’ book at all. It will be read only by adults. It is written only for adults.” But this was only a manner of speaking, Mark Twain’s way of asserting, with a discernible touch of irritation, the degree of truth he had achieved. It does not represent his usual view either of boys’ books or of boys. No one, as he well knew, sets a higher

The late Lionel Trilling (1905-1975) is remembered as a great literary critic, writer, and teacher. During his 43 years as a professor of literature and criticism at Columbia University, Trilling wrote several books, including The Liberal Imagination and Sincerity and Authenticity, published numerous essays, and worked with thousands of students. “Huckleberry Finn: 1948” is reprinted from The Moral Obligation to be Intelligent: Selected Essays, by Lionel Trilling. Copyright © 2000 by Lionel Trilling. Reprinted with permission of Farrar, Straus, and Giroux, LLC. The essay was first published as the introduction to a 1948 edition of Huckleberry Finn.

* William Dean Howells was a writer and editor of the Atlantic Monthly.



value on truth than a boy. Truth is the whole of a boy's conscious demand upon the world of adults. He is likely to believe that the adult world is in a conspiracy to lie to him, and it is this belief, by no means unfounded, that arouses Tom and Huck and all boys to their moral sensitivity, their everlasting concern with justice, which they call fairness. At the same time it often makes them skillful and profound liars in their own defense, yet they do not tell the ultimate lie of adults; they do not lie to themselves. That is why Mark Twain felt that it was impossible to carry Tom Sawyer beyond boyhood—in maturity “he would lie just like all the other one-horse men of literature and the reader would conceive a hearty contempt for him.”

Certainly one element in the greatness of *Huckleberry Finn*, as also in the lesser greatness of *Tom Sawyer*, is that it succeeds first as a boys' book. One can read it at ten and then annually ever after, and each year find that it is as fresh as the year before, that it has changed only in becoming somewhat larger. To read it young is like planting a tree young—each year adds a new growth ring of meaning, and the book is as little likely as the tree to become dull. So, we may imagine, an Athenian boy grew up together with the *Odyssey*. There are few other books which we can know so young and love so long.

The truth of *Huckleberry Finn* is of a different kind from that of *Tom Sawyer*. It is a more intense truth, fiercer and more complex. *Tom Sawyer* has the truth of honesty—what it says about things and feelings is never false and always both adequate and beautiful. *Huckleberry Finn* has this kind of truth, too, but it has also the truth of moral passion; it deals directly with the virtue and depravity of man's heart.

Perhaps the best clue to the greatness of *Huckleberry Finn* has been given to us by a writer who is as different from Mark Twain as it is possible for one Missourian to be from another. T.S. Eliot's poem “The Dry Salvages,” the third of his *Four Quartets*, begins with a meditation on the Mississippi, which Mr. Eliot knew in his St. Louis boyhood:

I do not know much about gods; but I think that the river
Is a strong brown god...

And the meditation goes on to speak of the god as

almost forgotten

By the dwellers in cities—ever, however, implacable,
Keeping his seasons and rages, destroyer, reminder of
What men choose to forget. Unhonoured, unpropitiated
By worshippers of the machine, but waiting, watching and
waiting.

Huckleberry Finn is a great book because it is about a god—about, that is, a power which seems to have a mind and will of its own, and which to men of moral imagination appears to embody a great moral idea.

Huck himself is the servant of the river-god, and he comes very close to being aware of the divine nature of the being he serves. The world he inhabits is perfectly equipped to accommodate a deity, for it is full of presences and meanings which it conveys by natural signs and also by preternatural omens and taboos: to look at the moon over the left shoulder, to shake the tablecloth after sundown, to handle a snakeskin, are ways of offending the obscure and prevalent

spirits. Huck is at odds, on moral and aesthetic grounds, with the only form of established religion he knows, and his very intense moral life may be said to derive almost wholly from his love of the river. He lives in a perpetual adoration of the Mississippi's power and charm. Huck, of course, always expresses himself better than he can know, but nothing draws upon his gift of speech like his response to his deity. After every sally into the social life of the shore, he returns to the river with relief and thanksgiving; and at each return, regular and explicit as a chorus in a Greek tragedy, there is a hymn of praise to the god's beauty, mystery, and strength, and to his noble grandeur in contrast with the pettiness of men.

Generally the god is benign, a being of long sunny days and spacious nights. But, like any god, he is also dangerous and deceptive. He generates fogs which bewilder, and contrives echoes and false distances which confuse. His sandbars can ground and his hidden snags can mortally wound a great steamboat. He can cut away the solid earth from under a man's feet and take his house with it. The sense of the danger of the river is what saves the book from any touch of the sentimentality and moral ineptitude of most works which contrast the life of nature with the life of society.

The river itself is only divine; it is not ethical and good. But its nature seems to foster the goodness of those who love it and try to fit themselves to its ways. And we must observe that we cannot make—that Mark Twain does not make—an absolute opposition between the river and human society. To Huck much of the charm of the river life is human: it is the raft and the wigwam and Jim. He has not run away from Miss Watson and the Widow Douglas and his brutal father to a completely individualistic liberty, for in Jim he finds his true father, very much as Stephen Dedalus in James Joyce's *Ulysses* finds his true father in Leopold Bloom.* The boy and the Negro slave form a family, a primitive community—and it is a community of saints.

Huck's intense and even complex moral quality may possibly not appear on a first reading, for one may be caught and convinced by his own estimate of himself, by his brags about his lazy hedonism, his avowed preference for being alone, his dislike of civilization. The fact is, of course, that he is involved in civilization up to his ears. His escape from society is but his way of reaching what society ideally dreams of for itself. Responsibility is the very essence of his character, and it is perhaps to the point that the original of Huck, a boyhood companion of Mark Twain's named Tom Blenkinship, did, like Huck, “light out for the Territory,” only to become a justice of the peace in Montana, “a good citizen and greatly respected.”

Huck does indeed have all the capacities for simple happiness he says he has, but circumstances and his own moral nature make him the least carefree of boys—he is always “in

*In Joyce's *Finnegans Wake* both Mark Twain and *Huckleberry Finn* appear frequently. The theme of rivers is, of course, dominant in the book; and Huck's name suits Joyce's purpose, for Finn is one of the many names of his hero. Mark Twain's love of and gift for the spoken language make another reason for Joyce's interest in him.

Huckleberry Finn has ...
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a sweat" over the predicament of someone else. He has a great sense of the sadness of human life, and although he likes to be alone, the words "lonely" and "loneliness" are frequent with him. The note of his special sensibility is struck early in the story:

Well, when Tom and me got to the edge of the hilltop we looked away down into the village and could see three or four lights twinkling where there were sick folks, maybe; and the stars over us was sparkling ever so fine; and down by the village was the river, a whole mile broad, and awful still and grand.

The identification of the lights as the lamps of sick-watches defines Huck's character.

His sympathy is quick and immediate. When the circus audience laughs at the supposedly drunken man who tries to ride the horse, Huck is only miserable: "It wasn't funny to me...; I was all of a tremble to see his danger." When he imprisons the intending murderers on the wrecked steamboat, his first thought is of how to get someone to rescue them, for he considers "how dreadful it was, even for murderers, to be in such a fix. I says to myself, there ain't no telling but I might come to be a murderer myself yet, and then how would I like it." But his sympathy is never sentimental. When at last he knows that the murderers are beyond help, he has no inclination to false pathos. "I felt a little bit heavy-hearted about the gang, but not much, for I reckoned that if they could stand it I could." His will is genuinely good and he has no need to torture himself with guilty second thoughts.

Not the least remarkable thing about Huck's feeling for people is that his tenderness goes along with the assumption that his fellow men are likely to be dangerous and wicked. He travels incognito, never telling the truth about himself and never twice telling the same lie, for he trusts no one and the lie comforts him even when it is not necessary. He instinctively knows that the best way to keep a party of men away from Jim on the raft is to beg them to come aboard to help his family stricken with smallpox. And if he had not al-

ready had the knowledge of human weakness and stupidity and cowardice, he would soon have acquired it, for all his encounters forcibly teach it to him—the insensate feud of the Graingerfords and Shepherdsons, the invasion of the raft by the Duke and the King, the murder of Boggs, the lynching party, and the speech of Colonel Sherburn. Yet his profound and bitter knowledge of human depravity never prevents him from being a friend to man.

No personal pride interferes with his well-doing. He knows what status is and on the whole he respects it—he is really a very *respectable* person and inclines to like "quality folks"—but he himself is unaffected by it. He himself has never had status, he has always been the lowest of the low, and the considerable fortune he had acquired in *The Adventures of Tom Sawyer* is never real to him. When the Duke suggests that Huck and Jim render him the personal service that accords with his rank, Huck's only comment is, "Well, that was easy so we done it." He is injured in every possible way by the Duke and the King, used and exploited and manipulated, yet when he hears that they are in danger from a mob, his natural impulse is to warn them. And when he fails of his purpose and the two men are tarred and feathered and ridden on a rail, his only thought is, "Well, it made me sick to see it; and I was sorry for them poor pitiful rascals, it seemed like I couldn't ever feel hardness against them any more in the world."

And if Huck and Jim on the raft do indeed make a community of saints, it is because they do not have an ounce of pride between them. Yet this is not perfectly true, for the one disagreement they ever have is over a matter of pride. It is on the occasion when Jim and Huck have been separated by the fog. Jim has mourned Huck as dead, and then, exhausted, has fallen asleep. When he awakes and finds that Huck has returned, he is overjoyed; but Huck convinces him that he has only dreamed the incident, that there has been no fog, no separation, no chase, no reunion, and then allows him to make an elaborate "interpretation" of the dream he now believes he has had. Then the joke is sprung, and in the growing light of the dawn Huck points to the debris of leaves on the raft and the broken oar.

Jim looked at the trash, and then looked at me, and back at the trash again. He had got the dream fixed so strong in his head that he couldn't seem to shake it loose and get the fact back into its place again right away. But when he did get the thing straightened around he looked at me steady without ever smiling, and says:

'What do dey stan' for? I'se gwyne to tell you. When I got all wore out wid work, en wid de callin' for you, en went to sleep, my heart wuz mos' broke bekase you wuz los', en I didn't k'yer no mo' what became er me en de raf'. En when I wake up en fine you back agin, all safe en soun', de tears come, en I could a got down on my knees en kiss yo' foot, I's so thankful. En all you wuz thinkin' 'bout wuz how you could make a fool uv ole Jim wid a lie. Dat truck dah is *trash*; en trash is what people is dat puts dirt on de head er dey fren's en makes 'em ashamed.'

Then he got up slow and walked to the wigwam, and went in there without saying anything but that.

The pride of human affection has been touched, one of the few prides that has any true dignity. And at its utterance, Huck's one last dim vestige of pride of status, his sense of his

position as a white man, wholly vanishes: "It was 15 minutes before I could work myself up to go and humble myself to a nigger; but I done it, and I wasn't sorry for it afterwards either."

This incident is the beginning of the moral testing and development which a character so morally sensitive as Huck's must inevitably undergo. And it becomes an heroic character when, on the urging of affection, Huck discards the moral

The Life that Shaped Mark Twain's Anti-Slave

By Ken Burns,
Dayton Duncan, and
Geoffrey Ward

He was a Southerner and a Northerner, a Westerner and a New England Yankee—a tireless wanderer who lived in a thousand places all around the world. He would call just two of them home: the Missouri town of his childhood, which he would transform into the idealized hometown of every American boy, and the magnificent Connecticut house he built for his wife and children, which he hoped would shelter them from hardship, but where heartbreak found them nonetheless.

During his long life, he was a printer's apprentice and a riverboat pilot, a prospector who never struck gold, and a confederate soldier who never fought a battle. He was considered the funniest man on earth—a brilliant performer on the lecture circuit who could entertain almost any audience—and a spectacularly inept businessman whose countless schemes to get rich quick threatened again and again to

Ken Burns, Dayton Duncan, and Geoffrey Ward collaborated to produce Mark Twain, a celebrated PBS documentary released in January 2002. Mark Twain carries viewers from rural Missouri, where Samuel Clemens spent his boyhood, to an estate in Connecticut where he raised his children and began to rethink his southern upbringing. This same team was responsible for PBS documentaries such as The Civil War and Baseball, for which they earned Emmy, Grammy, and People's Choice Awards. This article is excerpted with permission from the narrative of the film Mark Twain, produced by Florentine Films, Walpole, N.H.

bring him to ruin. But above all, Mark Twain was a writer, a natural born storyteller, and a self-taught genius with words who understood before anyone else that art could be created out of the American language.

He wrote constantly, newspaper stories, poetry, plays, political diatribes, travel pieces, irreverent musings about religion, and a series of autobiographical sketches noted as much, he admitted, for the tall tales they spun as for the truth they told. And he wrote books—books read by millions—including the deceptively simple story of a backwards boy and a runaway slave that showed his people a whole new way to think about themselves.

He was born Samuel Langhorne Clemens, the sixth of seven children, two months premature and so thin and sickly, his mother remembered, that "I could see no promise in him."

Every summer, Sam spent several weeks on his uncle's nearby farm. There, he and his cousins gathered in the evening in the cabin of an old slave they all called "Uncle Dan!" who thrilled them with ghost stories and introduced them to spirituals and jubilees. According to Ron Powers, a Twain biographer, "race was always a factor in his consciousness partly because black people and black voices were the norm for him before he understood there were differences. They were the first voices of his youth and the most powerful, the most metaphorical, the most vivid storytelling voices of his childhood. Uncle Dan'l and Aunt Hannah, who was rumored to be a thousand years old and a confidant of Moses, these were towering personalities to him."

One of his most lasting childhood memories was of a dozen men and women chained together waiting to be shipped down river to the slave market.

"They had," he said, "the saddest faces I ever saw."

By the 1870s, Samuel Clemens was an acclaimed writer, with a wife named Livy, three children, enormous wealth, and a magnificent house in Hartford, Conn., to match.

The Hartford house may have been the Clemens's home, but every summer for 20 years they packed up and moved back to Elmira, N.Y., to be with Livy's sister, Susan Crane, at her country place called Quarry Farm. The cook at Quarry Farm was an ex-slave named Mary Ann Cord. One late afternoon in 1874, as Sam and Livy and the children listened, she told them her life story. Twain was so moved by the way Mary Ann Cord told her story that he set out to put it down on paper, changing her name to "Aunt Rachel":

It was summer time, and twilight. We were sitting on the porch of the farmhouse, on the summit of the hill, and "Aunt Rachel" was sitting respectfully below our level, on the steps, for she was our servant, and colored. She was 60 years old, a cheerful, hearty soul, and it was no more trouble for her to laugh than for a bird to sing.

I asked her, "Aunt Rachel, how is it that you've lived 60 years without trouble?"

She said, "Misto Clemens, is you in 'arnest?"

"Why," I said, "I thought—that is, I meant—why, you *can't* have had any trouble. I never heard you sigh, and never seen your eye when there wasn't a laugh in it."

She said, "Has I had any trouble? Misto Clemens, I's gwyne to tell you, den I leave it to you. I was bawn down 'mongst de slaves...."

Mary Ann Cord had been born a slave in Virginia, where she married and gave birth to

code he has always taken for granted and resolves to help Jim in his escape from slavery. The intensity of his struggle over the act suggests how deeply he is involved in the society which he rejects. The satiric brilliance of the episode lies, of

course, in Huck's solving his problem not by doing "right" but by doing "wrong." He has only to consult his conscience, the conscience of a Southern boy in the middle of the last

(Continued on page 46)

y Views

seven children. Then in 1852, her family was torn apart.

An' dey sole my ole man, an' took him away, an' dey begin to sell my chil'en an' take *dem* away, an' I begin to cry; an' de man say, "Shet up yo' damn blubberin'," an' hit me on de mouf wid his han'. An' when de las' one was done but my little Henry, I grab *him* clost up to my breas' an' I ris up an' says, "You shan't take him away," I says; "I'll kill de man dat tetches him!" But my little Henry whisper an' say, "I gwyne to run away, an' den I work an' buy yo' freedom." But dey got him, de men did.

She lost touch with her husband and all her children. Years later, during the Civil War, she was living in North Carolina when black troops fighting for the Union occupied her owner's plantation and asked her to bring them breakfast.

I was a-stoopin' down by de stove, an' I'd jist got de pan o' hot biscuits in my han' an' was 'bout to raise up, when I see a black face come aroun' under mine, an' de eyes a-lookin' up into mine, an' I jist stopped *right dab*, an' never bugged! Jist gazed, an' gazed, an' de pan begin to tremble, an' all of a sudden I *knowed!* De pan drop' on de flo' an' I grab his lef' han' an' shove back his sleeve, an' den I goes for his forehead an' push de hair back so, an' "Boy!" I says, "if you ain't my Henry, what is you doin' wid dis welt on yo' wris' an' dat sk-yar on yo' forehead? De Lord God ob heaven be praise', I got my own ag'in!"

Oh, no, Misto Clemens, I hadn't had no trouble. An' no *joy*.

Mark Twain wrote down Mary Ann Cord's story precisely as she had told it and sent it off to *Atlantic Monthly* editor William Dean Howells with a note warning, "It has no humor in it. You can pay as lightly as you choose for that, if you want it," he added, "for it is rather out of my line." Titled "A True Story Repeated Word for Word As I Heard It," it marked his first appearance

in the *Atlantic Monthly*. The slave-owner's son from Missouri was discovering new ways of looking at the world.

Later, Twain began *The Adventures of Huckleberry Finn*, a work that would take him a decade to complete.

Huck's experiences with Jim turn upside down everything he has been taught about black people and white, about slavery and freedom, about good and evil. The novel reaches its moral climax when Huck is faced with a terrible choice. He believes he has committed a grievous sin in helping Jim escape and he finally writes out a letter telling Jim's owner where her runaway property can be found. Huck feels good about this at first he says and marvels at how close "I come to being lost and going to hell." But then he hesitates.

I got to thinking over our trip down the river; and I see Jim before me all the time: in the day and in the night-time, sometimes moonlight, sometimes storms, and we a-floating along, talking and singing and laughing. But somehow I couldn't seem to strike no places to harden me against him, but only the other kind. I'd see him standing my watch on top of his'n, 'stead of calling me, so I could go on sleeping; and see how glad he was when I came back out of the fog; ... and such-like times; and would always call me honey, ... and do everything he could think of for me, and how good he always was; and at last I struck the time ... [when he said] I was the best friend old Jim ever had in the world, and the *only* one he's got now; and then I happened to look around and see that paper.

I took it up, and held it in my hand. I was a-trembling, because I'd got to decide, forever, betwixt two things, and I knowed it. I studied a minute, sort of holding me breath, and then says to myself:

"All right, then, I'll *go* to hell"—and tore it up.

Bring Mark Twain to Your Classroom

■ Start with PBS's online, interactive scrapbook:

www.pbs.org/marktwain/scrapbook/index.html. Mark

Twain loved making scrapbooks; this is one he would be proud of. With pictures, quotes, essays, and chapters highlighting his journey from boyhood to literary immortality, this is the perfect place to get acquainted with Twain.

■ Next, order your copy of Ken Burns's *Mark Twain*:

www.pbs.org/marktwain/filmmakers/shop.html. This fasci-

inating, 220-minute documentary (which costs just \$24.98) reveals Twain's awakening to the horrors of slavery, his great success as a writer and repeated failures as a businessman, and his dedication to his wife and children—almost all of whom he outlived.

■ When you're ready to develop those lesson plans, head to the "Learn More" section:

www.pbs.org/marktwain/learnmore/index.html. Here,

you'll find five classroom activities for middle and high school students (don't miss #4 on how slavery affected Twain), selected writings (including excerpts from *Huckleberry Finn* and "A True Story, Repeated Word for Word as I Heard It"), a chronology of Twain's life, and links to other resources.

This fall, look for "Ken Burns American Stories," a new weekly series on PBS that will air many of Burns's documentaries: *Mark Twain* will air in two parts this November on the 18th and the 25th.

Inventing Numbers

How Mathematicians Filled the Inky Void

By David Berlinski

The most familiar of objects, numbers are nonetheless surprisingly slippery, their sheer slipperiness interesting evidence that certain intellectual tools may be successfully used before they are successfully understood. Numbers tend to sort themselves out by clans or systems, with each new system arising as the result of a perceived infirmity in the one that precedes it.

The natural numbers 1, 2, 3, 4, . . . , start briskly at 1 and then go on forever, although how we might explain what it means for anything to go on forever without in turn using the natural numbers is something of a mystery. In almost every respect, they are, those numbers, simply given to us, and they express a primitive and intimate part of our experience. Like so many gifts, they come covered with a cloud. Addition makes perfect sense within the natural numbers; so, too, multiplication. Any two natural numbers may be added, any two multiplied. But subtraction and division are curiously disabled operations. It is possible to subtract 5 from 10. The result is 5. What of 10 from 5? No answer is forthcoming from *within* the natural numbers. They *start* at 1.

The integers represent an expansion, a studied enlargement, of the system of natural numbers, one motivated by obvious intellectual distress and one made possible by two fantastic inventions. The distress, I have just described. And those inventions? The first is the number 0, the creation of some nameless but commanding Indian mathematician.

David Berlinski is the author of several books, including most recently, The Advent of the Algorithm: The 300-Year Journey from an Idea to the Computer. He has taught mathematics (as well as philosophy and English) at institutions such as Stanford, the City University of New York, and the Universite de Paris. This article is excerpted with permission of Random House, Inc., from several chapters of Berlinski's book, A Tour of the Calculus.

When 5 is taken away from 5, the result is nothing whatsoever, the apples on the table vanishing from the table, leaving in their place a peculiar and somewhat perfumed absence. What *was* there? Five apples. What *is* there? Nothing, *Nada*, Zip. It required an act of profound intellectual audacity to assign a name and hence a symbol to all that nothingness. Nothing, *Nada*, Zip, Zero, 0.

The negative numbers are the second of the great inventions. These are numbers marked with a caul: -504, -323, -32, -1. The result is a system that is centered at 0 and that proceeds toward infinity in both directions: . . . , -5, -4, -3, -2, -1, 0, 1, 2, 3, 4, Subtraction is now enabled. The result of taking 10 from 5 is -5.

And yet if subtraction (along with addition and multiplication) is enabled among the integers, division still provokes a puzzle. Some divisions may be expressed entirely in integral terms—12 divided by 4, for example, which is simply 3. But what of 12 divided by 7? In terms of the integers, it is nothing whatsoever and so calls to mind those moments on *Star Trek* when the transporter fails and causes the Silurian ambassador to vanish.

It is thus that the rational numbers, or fractions, enter the scene, numbers with a familiar doubled form: $\frac{2}{3}$, $\frac{5}{9}$, $1\frac{1}{32}$. The fractions express the relationship between the whole of things that have parts and the parts that those things have. There is that peach pie, the luscious whole, and there are those golden dripping slices, parts of the whole, and so two-thirds or five-ninths or seventeen-thirty-seconds of the thing itself. With fractions in place, division among the integers proceeds apace. Dividing 12 by 7 yields the exotic $1\frac{5}{7}$, a number that does not exist (and could not survive) amidst the integers. But fractions play in addition a conspicuous role in measurement and so achieve a usefulness that goes beyond division.

How Much and How Many

The natural numbers answer the oldest and most primitive of questions—*how many?* It is with the appearance of this question in human history that the world is subjected for the first time to a form of conceptual segregation. To count is to classify, and to classify is to notice and then separate, things falling within their boundaries and boundaries serving to keep one thing distinct from another.

The rational numbers, on the other hand, answer a more modern and sophisticated question—*how much?* Counting is an all or nothing affair. Either there are three dishes on the table, three sniffing patients in the waiting room, three aspects to the deity, or there are not. The question *how many?* does not admit of refinement. But *how much?* prompts a request for measurement, as in *how much does it weigh?* In measurement some extensive quantity is assessed by means of a scheme that may be made better and better, with even the impassive and uncomplaining bathroom scale admitting of refinement, pounds passing over to half pounds and half pounds to quarter pounds, the whole system capable of being *forever* refined were it not for the practical difficulty of reading through the hot haze of frustrated tears the awful news down there beneath all that blubber. This refinement, which is an essential part of measurement, plainly requires the rational numbers for its expression and not merely the integers. I may *count* the pounds to the nearest whole number; in order to *measure* the fat ever more precisely, I need those fractions.

With fractions in place, the system of numbers in which they are embedded undergoes a qualitative change. The integers are discrete in the sense that between 1 and 2 there is absolutely nothing. There is not much more, needless to say, between 2 and 3. Going from one integer to another is like proceeding from rock to rock across an inky void. The fractions fill up the spaces in the void, with $\frac{3}{2}$, for example, standing solidly between 1 and 2. There are now rocks between rocks—the void is vanishing—and rocks between rocks and rocks, with $\frac{1}{3}$ standing between $\frac{1}{4}$ and $\frac{1}{2}$. The filling-in of fractions between fractions is a process that goes on forever. That void has vanished. The number system is now *dense*, and not discrete, infinite in either direction (as the positive and negative integers go on and on) and infinite between the integers as well. In looking at the space between 1 and 2, swarming now with pullulating fractions, the mathematicians, or the reader, may for a moment have the unexpected sensation of peering into some sinister sinkhole—some hidden source of creation.

The Black Blossoms of Geometry: Inscribing Numbers on the Number Line

Geometry is a world within the world. The integers and the fractions represent the numbers with which that world must be coordinated. But geometry is one thing, arithmetic another. Taken on their own, they remain alien, one to the other. Analytic geometry represents a program in which arithmetic comes vibrantly to life within geometry, and so

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describes a process in which an otherwise severe world is made to blossom.

The program of analytic geometry is to evoke the numbers from the stubby soil of a geometrical landscape; it begins with a solitary line, something that lies in the imagination like a straight desert highway stretching from one blue horizon to the other. The traveler drifting down that highway, it is worth remembering, requires only *one* landmark to orient himself. Like the hero of innumerable westerns, he is heading *toward* Dodge City, or like the villain of those same westerns, *away* from Dodge City, Dodge City itself serving as the solitary point on the otherwise empty and lonesome stretch of road telling the cowpoke where he is going and the villain where he has been.

What is good enough for the cowboy is good enough for the mathematician. Looking at a given line, *he* picks a point to serve as a starting spot. That point functions as an *origin*, a source of things and a center of motion. But a point, it must be remembered, is *not* a number; holding place without size and arising whimsically whenever two straight lines are crossed, it is a geometrical object, a kind of fathomless atom out of which the line is ultimately created. Analytic geometry is a program to make this desert bloom; but if arithmetic is to be found here it can only be as the result of a deliberate assignment of numbers to points, a pairing of items that are incorrigibly distinct. The mathematician thus does not discover a number at the origin: He *invokes* one. Looking out over that linear landscape, the line bisected by a point, he assigns the number 0 to the origin, if only to convey the sense on the line already conveyed in the number system itself, that at 0 things have a beginning (0, 1, 2, 3, 4, ...) and at 0 they have an end (... , -4, -3, -2, -1, 0).

One number has been made to flower and break black blossoms on the line; the rest of them may be made to follow and crack the stony soil.

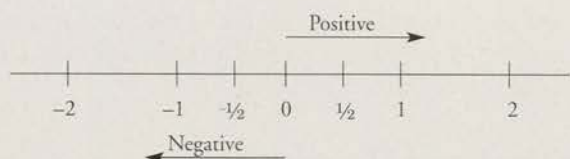
Having chosen an origin, the mathematician next chooses some fixed distance on the line to represent a unit distance. The choice of a unit is arbitrary. The distance is *fixed* because it is a measure of distance from

the origin. And it is a fixed *distance* because the mathematician is measuring spatial expanse. With a unit distance thus in place, a second number makes an appearance on the line. The point precisely one unit distance from the origin is assigned the number 1. The line has now been made to blossom twice.

The number 2 blossoms on the line at the point two units from the origin, and 3 follows in turn. Every natural number is represented in just the same way. The fractions on this scheme play the role that they always play, $\frac{1}{2}$, for example, denoting the point midway between 0 and 1. There are no surprises. Things are just as they seem. The scheme is simple.

If the positive integers and fractions indicate distance from the origin in one direction, the negative integers and fractions indicate distance from the origin in the other direction. It is here that the lucidity of a geometrical stage—its high desert light—may first be appreciated.

The Number Line



This elegant little exercise complete, the numbers have been inscribed on the geometric line, endowing the line with a living arithmetic content and being endowed by the line with a geometrical exoskeleton. Points on the line have now been assigned a numerical magnitude, and numbers a geometrical distance. It is possible to *measure* the distance between points and possible again to *see* the distance between numbers. Far from seeming strange, this interpretation of arithmetic and geometry strikes a deep, a resonant, chord of intuition suggesting that contrary to the historical development of these subjects, arithmetic and geometry are each aspects of a single, deeper discipline in which form and number are seamlessly matched and then merged.

The Unbearable Smoothness of Motion

And yet there is always a yet.

The geometrical line reflects the unbearable smoothness of motion perfectly; between points, there are points, those points falling in on themselves so that the line as a whole forms a *continuum*, an ancient mystic image of things at the margins of distinctness, a perfect expression of the passage we make from one place to another or from one time to another, the experience of continuity suggesting that at some level there is only *seamlessness*.

Yet the numbers are pretty hard-edged characters; each possesses a defiant sense of its own individuality, and none of them seems inclined to do much swimming toward the ocean of being. Or anything else. If points on the line find their separate identities a burden, the numbers positively *revel* in their individuality. This circumstance may provoke a squeak of suspicion, a sinister hunch that the line and the numbers inscribed upon it are in some way discordant. And although these remarks are delivered by a shrug of intuition,

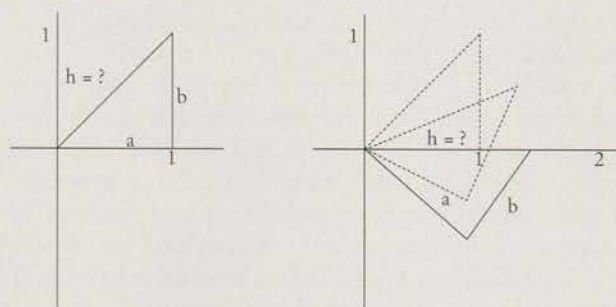
the shrug is backed up by an ancient argument.

The Ifs Accumulate

A theorem attributed to Pythagoras affirms that if **a** and **b** are the sides of a right triangle and **h** its hypotenuse, then $a^2 + b^2 = h^2$. The theorem embodies a striking *fact* about right triangles: whatever their particular configuration, *this* simple numerical relationship will hold among their sides. If **a** = 3 and **b** = 4, $a^2 + b^2 = 25$, and **h** must therefore be 5.

And so it is, the Pythagorean theorem embedding the waywardness of the world in an incorruptible set of conceptual constraints.

But suppose now that **a** and **b** are 1. The triangle answering to the supposition appears unremarkable. Its legs are each one unit in length. The thing seems somewhat squat. But what of **h** amid all this ordinariness? Among other things, **h** expresses the extent of a fixed and hopelessly prosaic distance in the real world. And if **h** is a distance in the real world, it is also a distance on the number line, a fact that may be seen by rotating the triangle so that its hypotenuse coincides with the axis of the number line itself. Thus inscribed on the number line, the endpoint of the hypotenuse is at precisely **h** from the origin.



So? What then *is h*? A distance of what *magnitude*?

It would be intellectually repugnant to learn that although **h** *is* some distance from here, it is a distance that *cannot* be correlated with any number.

To say this is to evoke one of those absurdist dramas so popular in the fifties. But it is nonetheless *appropriate* in the case of **h**, the suspicions and surmises now collecting themselves into a flat and sullen statement: *there is no way of telling*.

The overall argument is very simple, very compact, and very powerful. The Pythagorean theorem says that $a^2 + b^2 = h^2$, and it says so for *any* right triangle. If **a** and **b** are 1 and thus $a^2 + b^2 = 2$, **h** is then the number that when squared (or multiplied by itself) is 2. These trim and tidy inferential steps suffice to take the reader to the very edge of doom. If $a^2 + b^2 = 2$, h^2 must be 2 and **h** itself $\sqrt{2}$.

But no such number exists.

That square root of 2 is like the Yeti or the Loch Ness monster, the snows of yesteryear, the dusky ghost of the dusty window—it is not there, it cannot be found, it is not a part of the furniture of this or any other world.

The discussion is now embedded in a tangle of concepts. Just look at this crown of thorns. (continued)

The square root of 2? It doesn't exist? *You're putting me on, right?*—this said with the tone of incredulity with which on ordinary occasions we treat an old friend's announcement that he is about to depart for an ashram. The thing is puzzling. It puzzled the Greeks, and it puzzled mathematicians who came after the Greeks. It puzzled mathematicians filing down the centuries, God-intoxicated Hindu sages writing in the shadows of gorgeous temples, bearded Arabic scholars fingering their caftans, profit-eyed men of the Italian renaissance.

But there it is. The ancient proof is unassailable.

Poor Fat Things

Sixteen has a square root in 4, and $\frac{1}{4}$ a square root in $\frac{1}{2}$, but 2 has no square root whatsoever among the rational numbers, although it would appear that 2.25 has a square root in 1.5. *Fretfulness?* That is not quite the right word. An ancient impediment to understanding has come shambling out of the historical mists, dragging green slime behind it and snorting wetly. *Impediment?* Not quite the right word either. There are plenty of square roots beyond the square root of 2 that cannot be expressed in terms of the rational numbers—the square root of 3, for example. Like plush that under strong light reveals a series of alarming moth holes, the familiar number system is filled with strange gaps, places of reverberating emptiness. And the word for *that* is weird.

The square root of 2 forced the Greeks to the contemplation of *incommensurable magnitudes*—distances on the line that could not be correlated with any number. These are unlovely objects, those numberless distances, if only because like hairless dogs they exhibit their deficiencies so defiantly. The discovery of incommensurable magnitudes provoked a crisis among Greek mathematicians committed (as most mathematicians are) to the supremacy of numbers.

The crisis they provoked, the Greeks never resolved. In Eudoxus and in Euclid, incommensurable magnitudes make an appearance as incommensurable magnitudes, strange numberless objects. Ratios of such objects are taken and a scheme of geometry created, but in the end, there the poor fat things sit: obscure, implausible, and bizarre.

The great Hindu and Arabic mathematicians of the Middle Ages took quite another tack. Whatever incommensurable magnitudes might be, they treated such things *as if* they were really numbers—*irrational* numbers, the *irrational* a nice inadvertent touch signifying the madness loitering about the very notion—and learned many tricks by which such numbers might be manipulated. In the 12th century, for example, Bhāskara demonstrated correctly that $\sqrt{3} + \sqrt{12} = 3\sqrt{3}$. But neither Bhāskara nor anyone else ever made clear what items such as $\sqrt{3}$ *were*. The symbols resisted, as symbols so often do, any attempt to invest them with meaning. Sitting in their perfumed gardens, those thousand and one Arabian mathematicians carried out their calculations with a charming and insouciant assurance that all that gibberish actually made sense.

Not that anyone else did any better, the high medieval gibberish of Arabic mathematics appearing in Italy, France, and England as an inexpungably vital but irremediably vul-

gar weed. And the curious counterintuitive thing is that it didn't matter. The commonplace view of mathematics as a discipline *consecrated* to the ideal of precision has very little to do with mathematics as it is lived. Between 1500 and 1800, the great central stage of European thought is crowded with babbling and arguing figures—Cardano, Stifel, Pascal, Descartes, Wallis, Barrows, even Leibniz and the sainted Newton—saying one thing but writing quite another, agreeing in solemn convocation that irrational numbers are a fiction (almost a certain sign of bad faith, in mathematics or anything else), and then applying that fiction to numerical problems and like Bhāskara miraculously getting the answer right, the work involved in the creation of the calculus a matter evidently capable of being conducted *without* being clarified.

The straight line and the numbers themselves are somehow hopelessly discordant, the sense of dislocation all the more pressing and all the more poignant in virtue of the conviction—one shared by almost any mathematician—that the line should express the numbers and the numbers should represent the line, and that both expression and representation should be perfect and complete.

The Doctor of Discovery

In his remarkable essay, *Continuity and Irrational Numbers*, the 19th-century mathematician Richard Dedekind wrote with a sense of dawning discovery that it was severability that gave the line its essence, its past. Let us suppose, Dedekind supposed, that at a point the geometrical line is in imagination cut. The result of the cut just made is a division of the line into two segments, **A** and **B**. Every point in **A** is to the left of every point in **B**. Every point on the line determines one, and only one, cut.

It is best to think of Dedekind as a great diagnostician, a doctor of discovery. The facts are in order; but the *facts* have always been in order. The *facts* have been in plain sight for more than two thousand years. Here they are, those facts. Some distances on the line cannot be correlated with any natural or rational number. And the numbers contain gaps, places where there should be something but where there is nothing instead. There is something about the line, some kind of continuity, some special property, some thing or aspect, some feature or condition; but when it came to specifying what that thing, aspect, feature, or condition was, mathematicians were silent.

The line is in some sense richer than the numbers that are used to represent it, and this is an old, an inconvenient fact; but Dedekind's diagnosis of this problem goes beyond a revisiting of such facts in order to display the long-hidden source of the discrepancy between line and number. Every rational number, he argued, produces a cut among the numbers; but some cuts answer to no rational number and in this respect—*this alone, no other*—the numbers and the line are different. Dedekind's calm but profound investigation succeeds as an act of intellectual liberation because it connects a particular fact—that some distances cannot be measured by any rational number—with the much larger, the more general, fact that some *cuts* cannot be made at any rational number.

It is the strength of Dedekind's diagnosis that it suggests its own remedy. If the rational numbers are filled with gaps, new numbers, Dedekind urged, are needed to make good the deficiencies. Mathematicians before Dedekind had simply invoked the irrational numbers with a certain hearty carelessness, trusting in their superb intuition to get things right. In Dedekind's diagnosis, new numbers arise as the result of an *informed* act of creation.

The axiom that achieves these aims is surpassingly spare. "Whenever, then, we have to do with a cut **A** and **B**," Dedekind writes, "produced by no rational number, we *create* a new, an *irrational* number." These may seem desultory words, but Dedekind is able to paint the portrait of this new number precisely and so at least to supply the lineaments of the desired miracle. It is to be a number in set **A** greater than any other number in **A**; and thus a number less than any number in set **B**. The axiom itself serves to *compel* such a number into existence. Given any cut of the number line and, therefore, any cut of the numbers into two camps **A** and **B**, *there exists*, the axiom says—there *must* exist, the mathematician adds—one and only one number in **A** larger than any other number in **A**, the imperious *there exists* bringing something new into the world and so allowing the mathematician to share in the general mystery of creation. In the case of rational cuts, the axiom ratifies what is evident: the rational cuts are made at the numbers. But where before there was nothing more than an emptiness answering to the square root of 2, a new number now appears, a Dark Prince, an object utterly unlike any rational number, one fled from the shadows and full of brooding mystery.

Dedekind published the results of his research in 1872 and so within the memory of the very oldest widow of a Civil War veteran, and I mention this in order to connect by some living tissue this moment with that one. The calculus had already been in existence for more than two centuries in 1872. If the calculus is much like a cathedral, its construction the work of centuries, it remained until the 19th century a cathedral suspiciously suspended in midair, the thing simply hanging there, with no one absolutely convinced that one day that gorgeous and elaborate structure would not come crashing down and fracture in a thousand pieces. Dedekind's axiom is *logically* among the fundamental affirmations of the calculus. With the axiom in place, the cathedral has a foundation. An assumption has been evoked to dispel a mystery.

Real World Rising

In the beginning, the natural numbers, 1, 2, 3, 4,.... Then 0 and the negative numbers. Next, the rational numbers, or fractions. And finally the irrational numbers. I have not said what the irrational numbers *are*, only that the real number system obeys Dedekind's axiom. Like members of a goofy lodge, the other numbers express their identities unself-consciously, but the square root of 2? It has come into existence as the result of an assumption; it stands to the other numbers in a certain relationship; when multiplied by itself it yields the number 2. But after all is said and done the thing seems determined entirely by the relationships it entertains.

A rational number or fraction, it is worthwhile to recall, enjoys a double identity, one that is on many occasions useful, as double identities often are. The number $\frac{1}{2}$, for example, may be written in decimal notation as 0.5 and the number $\frac{15}{28}$ as 0.53571428571428. Now the square root of 2 may *also* be written in decimal notation, for a start as 1.414. The notation serves to restore the irrational numbers to a certain community of numbers, for, in form, 1.414 and 0.53571428571428 appear to be objects of roughly the same kind. To the extent that decimal notation serves this psychological purpose, no harm is done. But the decimal expansion of a *rational* number—the numbers after the decimal point—is either finite, as in the case of 0.5, or doomed to repeat itself after a period, and so appears among the numbers as one of those tiresome ghosts returning every Halloween to the same fireplace, where they may be found rubbing their hands and looking mournful and making clanking sounds. In the decimal expansion of $\frac{15}{28}$, the sequence 571428 occurs over and over again, clanking away.

The contrast to the irrational numbers is striking. The decimal expansion of an irrational number *never* repeats itself. Instead, the expansion trails off into the far future, each of its digits something of a surprise, the result of a unique and infinitely long object with little by way of pattern or plan to ease the understanding. The square root of 2 is 1.414, and beyond that 1.4142, and beyond that 1.414212552...; from what has gone before, there is no telling what is to come. The digits expressing this number are unpredictable, random, unique, solitary, infinite, and unfathomable. They retain an element of unavoidable mystery. Like the human soul, an irrational number is only partly known, and however more is known of either there is always infinitely more to know.

* * *

Whatever the ultimate identity of the irrational numbers, what is known about them is of less importance than what is known of the great system in which they are embedded.

That system is *severable*. Dedekind's axiom is in force, flooding the numbers with light, flushing the irrationals from the shadows. Addition, subtraction, multiplication, and division, the immemorial operations of childhood, are entirely enabled; thus enabled, they allow the irrational numbers to function *as* numbers: $\sqrt{3} + \sqrt{12} = 3\sqrt{3}$, because the square root of 12 may be written as $\sqrt{4 \times 3}$ and then as $2\sqrt{3}$, making three of those square roots in all.

The system is *ordered*. Any number if it is not equal to 0 is either greater than 0 or less than 0. It is a system in which every number finds its place and there is a place for every number.

And the system is *complete*. There are no gaps to be filled. Any cut among the numbers falls like the stroke of an ax upon a single number. Positive numbers have roots within the system. The strange black nothingness that opened up among the rational numbers is gone. Incommensurable magnitudes are no longer incommensurable. The correspondence between the geometric line and the real numbers is perfect and unblemished. □

CURING PROVINCIALISM

(Continued from page 11)

mary function. They have all sorts of other valuable attributes, as well. As to teaching art, my view is that we should begin with the rudiments: drawing, theory of color, composition, and maybe modeling; similarly, in music: sight reading, playing an instrument, and perhaps playing in a band. These things have the potential to elicit the interest of the young in a particular type of art.

Also, art can be taught as an adjunct to history. After all, we put the great portraits of George Washington and Benjamin Franklin and Alexander Hamilton in our American History books. Such historical art makes a general impression on students: The costumes that are worn give away the century in which they lived. The artifacts in the painting tell us something about their day-to-day lives. As for teaching “appreciation” of the history of the arts, there is no time in the schedule for a thorough treatment of either. Each needs a sequence of courses, and the hit-and-run substitutes that are often tried do more harm than good.

Editor: What about foreign language? Its place in the curriculum has suffered in recent decades. Does knowing one give us a special window on the world? Should it be restored to its previous importance?

Barzun: A foreign language is very necessary. It, too, de-provincializes, because it presents the world from a different angle through the very fact that the vocabulary is different and deals with reality in its own peculiar way. The things that you can or can't say in a given language, what makes sense to the French or the Germans in contrast to what makes sense to us, are mind-opening. In addition, there is practical utility in mastering a particular language: it serves to give access to a whole literature, and possibly furthers one's career.

I'm in favor of teaching Latin, of course, but I think that battle has been lost permanently. It's too bad because it is a gateway to all the Romance languages, and even to German, by familiarizing the mind with declension and other features of grammar that, in English, are lost or hidden through usage. Quite apart from this aid to studying foreign languages, learning Latin makes reading and writing English easier. Latin roots explain the meaning of many English words, and Latin grammar shows the relations among words in a sentence so clearly that common blunders in English sentence construction quickly reveal themselves for correction.

Editor: Can you give me an example or two of ways in which a particular language is able to convey something that can't be similarly conveyed in another language? For example, it's often said that the Inuit language has many ways to say “snow,” depending on whether it is icy or slushy, and so on.

Barzun: I wasn't thinking so much of a finer discrimination among objects as I was the slant on ordinary things. For example, we in America understand perfectly well what we mean when we say a “glorious” morning. If you said that in

Such historical art makes a general impression on students: The costumes that are worn give away the century in which they lived. The artifacts in the painting tell us something about their day-to-day lives.

France, people would be puzzled. Has a battle been won on the front? “Glorious” here can apply to the weather—in France, it cannot. Why is that? The very perception that there is a “why” (to which there is no answer) is an eye opener. What is foolish in one idiom is clear as day in another. The two languages have two ways of cutting up the experience of the world.

Again, as another example, we “know” Mr. Jones and we “know” how to swim. Most often, European languages have two different words for *acquaintance with* and *knowledge*. On top of all this are the innumerable idioms that point to realities that one language or another ignores—which is why we borrow such terms as: *belles-lettres*, *coup d'état*, *haute couture*, *fait accompli*....

Editor: What's your summarizing message to teachers?

Barzun: I'd like, if I may, to sum up the benefits that should logically result from the proper teaching of the subjects we—and many others—have agreed on. They are fit for all minds, endowing students with particular and general abilities to think, speak simply and clearly, express views rationally, know and use a body of facts and ideas that help communicate because they are widely known, detect errors and fallacies, and resolve intellectual problems.

To be sure, these are lofty goals. To reach them regularly and to the fullest would imply flawlessness in teacher and taught, which is not humanly possible. We must accept an approximation, and when the effort is made by competent teachers and administrators, it can be done. It has been done. □

THE WHOLE SHEBANG

(Continued from page 23)

blow, because the jumpers and the atmosphere are *already moving* with the turning earth, and so tend to remain in motion. Today we have seen enough of the universe to know that motion, not rest, is the ordinary state of matter, and that to be immobile is at most a local trait, measured in terms of a local “inertial rest frame.” The farther out one looks, the more one finds that everything, relative to most other things, is moving. The universe was born restless and has never since been still.

Galileo’s later years were overshadowed by his futile campaign to persuade the Church to replace the Ptolemaic with the Copernican cosmology. In the end he was forced to make a humiliating recantation on his knees before the Inquisition, and he lived out the remainder of his days under house arrest. But the reason his campaign failed was not solely that the authorities in Rome were unwilling to change their ideas. It was also because Galileo, though armed with many powerful arguments from analogy, was never able to present a quantitative defense of the Copernican cosmology. That was accomplished by Isaac Newton.

Newton Provides the Equations

In *The Principia*, Newton presented equations that accurately predicted the motions of the planets and the rate at which objects fall on Earth, revealing both to be caused by a single force, gravity. In so doing, it vindicated the heliocentric, rotating-Earth cosmology of Copernicus, Kepler, and Galileo, while also uniting the physics of heaven and Earth. Newton’s research inaugurated two scientific enterprises that have continued ever since—the progress of physics through the investigation of phenomena both on Earth and beyond, and the mapping of a universe that, though vast, is for some reason accessible to human inquiry.

Substantial progress in mapping the solar system was made during the two centuries following the publication, in 1687, of Newton’s *Principia*. Explorers armed with telescopes and accurate clocks—marine chronometers, developed to enable navigators to determine their longitude and thus avoid blundering into coastlines at night—observed the transits of Venus across the face of the sun in 1761 and 1769 with results that yielded a fairly accurate value for the size of the earth’s orbit. This in turn paved the way for measuring the distances to nearby stars by triangulation (the “parallax” method). The first accurate stellar parallax—that of the star 61 Cygni, 11 light-years from Earth—was measured in 1838.

The Rise of Astrophysics

Meanwhile, astronomy advanced from its original, taxonomic phase—in which observers classified celestial objects in something like the way naturalists collected dried plants and stuffed birds by the thousands in the days before Darwin—to mature into *astrophysics*, a science that not only reports extraterrestrial phenomena but offers plausible explanations for how they work. The change was rather like watching a play in a foreign language one does not speak, only to have the patterns of behavior become explicable in

the second act when a translator begins to whisper explanations of what the actors are saying and how they are motivated. Through astrophysics, it became possible to go beyond describing how the sky looks and to begin learning how it got to be that way.

Essential to the rise of astrophysics was the spectroscope, which breaks down light into its constituent frequencies. The most cosmologically significant discovery to be made with the help of the spectroscope came in 1929 when American astronomer Edwin Hubble used it to confirm that most galaxies are rushing away from the Milky Way, and from one another, at rates directly proportional to their distances—the first demonstration that the universe is expanding.

The Big Bang Model is Born

The idea that cosmic space is stretching out, carrying the galaxies with it, is a 20th-century innovation—one that was unanticipated, insofar as I can find, in all the prior scientific literature. Yet curiously, the idea of cosmic expansion emerged in theoretical physics shortly before Hubble found evidence of it in the sky. The groundwork was laid in 1916 by Einstein’s general theory of relativity. Researchers studying the theory found that it implied that cosmic space cannot be static but must be either expanding or contracting. Einstein at first resisted this odd idea, but soon found himself obliged to accept the validity of the mathematical reasoning involved. Then in 1929 Hubble, who was not familiar with the theory, independently discovered the expansion of the universe.

CMB Theory Develops, Predictions are Made

The so-called “big bang” model arose from thinking about what an expanding universe would have been like in its infancy. The observable universe today is roughly 15 billion light-years in radius. When its radius was much smaller—only one light-year, say—all the matter in the universe must have been packed together in a lot less space. Any given quantity of matter, compressed to a higher density, gets hotter: That’s why a penny, lifted off a railroad track moments after being flattened by a passing train, is hot to the touch, and why compressing air in a bicycle pump heats the air, making the pump warm. So it seems reasonable to imagine that the early universe may have been not only dense, but also hot. *Very* hot: When the universe was one second old, in this scenario, every spoonful of stuff was denser than stone and hotter than the center of the sun. The expansion and resultant cooling of the universe permitted the formation of atoms, molecules, galaxies, and living creatures. What we call *matter* is frozen energy. It froze because the universe, owing to its expansion, cooled.

The big bang theory implied that as the young universe expanded there should have come a time, nowadays reckoned at about five hundred thousand years after the beginning, when the primordial plasma thinned out sufficiently to become transparent to light. Physicists call this event *photon decoupling*, meaning that photons, the particles that constitute light and other forms of electromagnetic energy, were at this point set free. Thereafter they did not often interact

with one another, or with matter, but went soaring unhampered through the constantly expanding reaches of cosmic space. Hence most of them should still be around today. Cosmic expansion would have stretched them out, increasing their wavelengths from those of light to the wavelengths we call microwave radio. In microwave frequencies it is convenient to express energy in terms of temperature—as does, say, the instruction manual that accompanies a microwave oven—so another way to reason through this argument is to say that the universe, having once been hot, should remain a bit warm even today.

Physicists theorizing about the existence of this *cosmic microwave background*, or CMB, calculated that it should have a temperature of about three degrees above absolute zero. They also noted that it would display a “black body” spectrum, as is dictated by the relevant quantum physics equations, and that it should be *isotropic*, meaning that any observer, anywhere in the universe, should measure the background as having the same temperature everywhere in the sky.

One can think of the CMB as a haze of photons that has permeated space ever since the big bang. As we look far out in space—and, therefore, backward in time, to when the CMB photons were more energetic—we find the haze thickening. At the ultimate distance, where we are peering back into the first million years of time, the haze becomes opaque. Every observer using a microwave radio telescope thus sees the universe as a sphere that is almost transparent nearby but is opaque at its distant and fiery walls.

The Predictions Pan Out

When these predictions about CMB were first made, in the 1940s, they were quickly forgotten. The big bang theory was not yet taken very seriously and there was no such thing as a microwave radio receiver. Then, in 1965, two physicists working with a radio receiver built for communications satellite experiments detected the CMB. Interest mounted as scientists came to appreciate that by studying the CMB they could make direct observation of the universe as it was only half a million years after the beginning of time.

In 1989, the American space agency launched a satellite designed to study the CMB from orbit, where its detectors were free from the interference of Earth’s atmosphere. Preliminary findings obtained by the COBE (Cosmic Background Explorer) satellite were announced the following year, and turned out to constitute a stunning confirmation of the big bang model. The CMB is indeed isotropic—that is, it has equal intensity all over the sky, as anything genuinely universal must. And, as expected, its temperature is about three degrees above absolute zero—2.726 degrees, to be exact. And its spectrum conforms to a black body spectrum: The fit is so precise that the researchers making the announcement had to enlarge the size of the error bars on their diagrams: Otherwise the observational data points would have disappeared into the thin, inked line describing the theoretical prediction.

A final triumph for the COBE scientists came in 1992, when an all-sky map, carefully compiled by repeated observations that pushed the sensitivity of the COBE instruments

Preliminary findings obtained by the COBE (Cosmic Background Explorer) satellite were announced the following year, and turned out to constitute a stunning confirmation of the big bang model.

to their limits, confirmed another important prediction of the big bang theory—that matter, though generally distributed uniformly throughout the cosmos, began fairly early to clump into dense regions from which clusters of galaxies were to form. This was good news for theorists who argued that the vast clusters, superclusters, and bubbles of galaxies we see in the universe today formed by gravitational attraction from *inhomogeneities* in the early universe. The clumps of matter are thought to have originated as *quantum fluctuations*, microscopic departures from the generally homogeneous distribution of matter in the very early universe. Much remains to be studied about the spectrum and sizes of these inhomogeneities, and how, exactly, they resulted in the large-scale structures we see in the universe today. These findings led most cosmologists to agree that the universe emerged from a hot big bang state.

The Observational Evidence Accumulates

Several other sorts of evidence support the big bang theory, including these:

- The *cosmic element abundance* fits the predictions of the theory. Here the line of reasoning is that as the primordial fireball cooled, protons and neutrons would have joined up to form the nuclei of atoms. The calculations of the nuclear physicists—who have had a lot of experience in this sort of

thing, since similar processes occur in the explosions of thermonuclear bombs—indicate that about a quarter of the atom-making stuff should have been converted into helium in the big bang, along with a bit of lithium, while the remainder survived as hydrogen (the simplest atom, whose nucleus in its rudimentary form consists of a single proton). And this is just what we do find: The universe at large is 25 percent helium and 73 percent hydrogen. The theory postulates that all the heavier elements were forged inside stars, notably in *supernovae*—exploding stars, which seed space with clouds of debris, enriched with the heavier elements, from which condensed latter-day stars and planets, the earth and the sun among them. If this theory is correct we should find that older stars are poorer in heavy elements than younger stars are. And this, too, turns out to be the case.

■ In a big bang universe it ought to be possible to see direct evidence of cosmic evolution by looking out to great distances, since light reaching us from billions of light years away is billions of years old and so reveals what things were like billions of years ago. Such evidence has indeed been found. Much of the bright promise of deep-space astronomy comes from the prospect of directly observing cosmic evolution by using more powerful telescopes as time machines to look at the universe as it was in the distant past.

■ The ages of stars fit the age of the universe deduced from its expansion rate—according to some of the data, at least. Several persuasive sets of observations suggest the universe has been expanding for approximately 15 billion years. This accords with the ages of the oldest known stars, estimated by astrophysicists at about 14 billion years. But there are other observations, which some researchers regard as persuasive, that yield a younger universe. If these prove to be correct, then something is wrong either with our understanding of the ages of the oldest stars or with some aspect of the big bang theory.

Concurrence of Other Theories

In addition to arguments based on observations, there are what might be called the *theoretical* proofs of the big bang scenario. It may seem perverse to speak of using one theory to prove another, since theories normally stand or fall on the verdict of observation and experiment. But facts in themselves are as disorderly as cornflakes without a bowl. In practice, science does a lot of pouring cornflakes from box to bowl—checking not just whether facts fit a given theory, but whether the theories work well together. If we ask in what regard the big bang accords with other well-established theories, we find several answers.

■ General relativity has survived a great many experimental tests and seems to be perfectly accurate insofar as one is concerned with making predictions about the behavior of gravity under conditions that currently prevail throughout most of the universe. And general relativity implies that the universe must be either expanding or contracting. So the very fact that we find evidence of cosmic expansion in the sky means that a well-established theory, relativity, supports another more hypothetical one, the big bang.

■ Quantum physics, too, finds a gratifying place within the big bang scheme. Using quantum mechanics, physicists are able to predict the existence and spectrum of the cosmic microwave background, calculate how much of the primordial material was turned into helium in the big bang, and estimate the ages of the oldest stars. Quantum physics makes accurate predictions about events involving three of the four fundamental forces of nature—the weak and strong nuclear forces at work in atoms, and electromagnetism, the force responsible for light and radio energy. But there is not as yet a fully accomplished quantum theory of the fourth force, gravity. This would not matter much were the province of physics limited to the contemporary universe: Gravitation is so weak that it can be disregarded when calculating the interactions of subatomic particles, which have such small mass that their gravitational pull on one another is negligible. But in the high-density early universe, subatomic particles weighed so much that their mutual gravitational influence was comparable to their interactions via the other three forces. To reconstruct events thought to have transpired during the very first fractions of a second of cosmic time will require a quantum account of gravity. Such a theory presumably would lay bare a single principle underlying both quantum mechanics and general relativity, which at our present level of understanding are based on contradictory ways of looking at the world.

■ The *inflationary* hypothesis has generated considerable interest in cosmology. It proposes that during a dawning moment of cosmic history the expansion of the universe proceeded much faster than had been thought—indeed, at a rate far greater than the velocity of light. The inflationary hypothesis not only solves several problems that afflicted earlier versions of the big bang theory but indicates that the universe is extremely large, and flings open a door onto the startling speculation that our universe originated as a microscopic bubble arising from the space of an earlier universe, which may in turn be one among many universes strewn like stars across inaccessible infinities of random spaces and times and sets of natural laws.

To sum up, as the 21st century opens, the big bang theory looks to be in pretty good shape. It is supported by several solid and more or less independent lines of evidence, and has at present no serious rivals. A lot of work remains to be done. Recently, for instance, astronomers have found evidence that the cosmic expansion rate is actually speeding up, rather than slowing down as had been assumed. Theorists speculate that a “dark energy” field is causing the accelerated expansion. If so, the nature of dark energy, as well as dark matter, remains to be adduced.

Nonetheless, if one were asked to make a list of the greatest scientific accomplishments of the century, somewhere on that list—along with relativity and quantum theory, the elucidation of the DNA molecule, the eradication of smallpox and the suppression of polio, the discovery of digital computation, and many other worthy attainments—there would be a place for big bang cosmology. □

HUCKLEBERRY FINN

(Continued from page 35)

century, to know that he ought to return Jim to slavery. And as soon as he makes the decision according to conscience and decides to inform on Jim, he has all the warmly gratifying emotions of conscious virtue.

Why, it was astonishing, the way I felt as light as a feather right straight off, and my troubles all gone.... I felt good and all washed clean of sin for the first time I had ever felt so in my life, and I knowed I could pray now.

And when at last he finds that he cannot endure his decision but must sacrifice the comforts of the pure heart and help Jim in his escape, it is not because he has acquired any new ideas about slavery—he believes that he detests Abolitionists; he himself answers when he is asked if the explosion of a steamboat boiler had hurt anyone, “No’m, killed a nigger,” and of course finds nothing wrong in the responsive comment, “Well, it’s lucky because sometimes people do get hurt.” Ideas and ideals can be of no help to him in his moral crisis. He no more condemns slavery than Tristram and Lancelot condemn marriage; he is as consciously *wicked* as any illicit lover of romance and he consents to be damned for a personal devotion, never questioning the justice of the punishment he has incurred.

Huckleberry Finn was once barred from certain libraries and schools for its alleged subversion of morality. The authorities had in mind the book’s endemic lying, the petty thefts, the denigrations of respectability and religion, the bad language, and the bad grammar. We smile at that excessive care, yet in point of fact *Huckleberry Finn* is indeed a subversive book—no one who reads thoughtfully the dialectic of Huck’s great moral crisis will ever again be wholly able to accept without some question and some irony the assumptions of the respectable morality by which he lives, nor will ever again be certain that what he considers the clear dictates of moral reason are not merely the engrained customary beliefs of his time and place.

We are not likely to miss in *Huckleberry Finn* the subtle, implicit moral meaning of the great river. But we are likely to understand these moral implications as having to do only with personal and individual conduct. And since the sum of individual pettiness is on the whole pretty constant, we are likely to think of the book as applicable to mankind in general and at all times and in all places, and we praise it by calling it “universal.” And so it is; but like many books to which that large adjective applies, it is also local and particular. It has a particular moral reference to the United States in the period after the Civil War. It was then when, in T.S. Eliot’s phrase, the river was forgotten, and precisely by the “dwellers in cities,” by the “worshippers of the machine.”

The Civil War and the development of the railroads ended the great days when the river was the central artery of the nation. No contrast could be more moving than that between the hot, turbulent energy of the river life of the first part of *Life on the Mississippi* and the melancholy reminiscence of the second part. And the war that brought the end of the rich Mississippi days also marked a change in the

No one who reads thoughtfully the dialectic of Huck’s great moral crisis will ever again...be certain that what he considers the clear dictates of moral reason are not merely the engrained customary beliefs of his time and place.

quality of life in America which, to many men, consisted of a deterioration of American moral values. It is, of course, a human habit to look back on the past and to find it a better and more innocent time than the present. Yet in this instance there seems to be an objective basis for the judgment. We cannot disregard the testimony of men so diverse as Henry Adams, Walt Whitman, William Dean Howells, and Mark Twain himself, to mention but a few of the many who were in agreement on this point. All spoke of something that had gone out of American life after the war, some simplicity, some innocence, some peace. None of them was under any illusion about the amount of ordinary human wickedness that existed in the old days, and Mark Twain certainly was not. The difference was in the public attitude, in the things that were now accepted and made respectable in the national ideal. It was, they all felt, connected with new emotions about money. As Mark Twain said, where formerly “the people had desired money,” now they “fall down and worship it.” The new gospel was, “Get money. Get it quickly. Get it in abundance. Get it in prodigious abundance. Get it dishonestly if you can, honestly if you must.”*

With the end of the Civil War capitalism had established itself. The relaxing influence of the frontier was coming to an end. Americans increasingly became “dwellers in cities” and “worshippers of the machine.” Mark Twain himself became a notable part of this new dispensation. No one worshipped the machine more than he did, or thought he did—he ruined himself by his devotion to the Paige typesetting machine, by which he hoped to make a fortune even greater than he had made by his writing, and he sang the praises of the machine age in *A Connecticut Yankee in King Arthur’s Court*. He associated intimately with the dominant figures of American business enterprise. Yet at the same time he hated the new way of life and kept bitter memoranda of his scorn, commenting on the low morality or the bad taste of the men who were shaping the ideal and directing the destiny of the nation.

Mark Twain said of *Tom Sawyer* that it “is simply a hymn, put into prose form to give it a wordly air.” He might have said the same, and with even more reason, of *Huckleberry Finn*, which is a hymn to an older America forever gone, an America which had its great national faults, which was full of violence and even of cruelty, but which still maintained

*Mark Twain in *Eruption*, edited by Bernard De Voto, p. 77.

its sense of reality, for it was not yet enthralled by money, the father of ultimate illusion and lies. Against the money-god stands the river-god, whose comments are silent—sunlight, space, uncrowded time, stillness, and danger. It was quickly forgotten once its practical usefulness had passed, but, as Mr. Eliot's poem says, "The river is within us...."

In form and style *Huckleberry Finn* is an almost perfect work. Only one mistake has ever been charged against it, that it concludes with Tom Sawyer's elaborate, too elaborate, game of Jim's escape. Certainly this episode is too long—in the original draft it was much longer—and certainly it is a falling off, as almost anything would have to be, from the incidents of the river. Yet it has a certain formal aptness—like, say, that of the Turkish initiation which brings Molière's *Le Bourgeois Gentilhomme* to its close. It is a rather mechanical development of an idea, and yet some device is needed to permit Huck to return to his anonymity, to give up the role of hero, to fall into the background which he prefers, for he is modest in all things and could not well endure the attention and glamour which attend a hero at a book's end. For this purpose nothing could serve better than the mind of Tom Sawyer with its literary furnishings, its conscious romantic desire for experience and the hero's part, and its ingenious schematization of life to achieve that aim.

The form of the book is based on the simplest of all novel-forms, the so-called picaresque novel, or novel of the road, which strings its incidents on the line of the hero's travels. But, as Pascal says, "rivers are roads that move," and the movement of the road in its own mysterious life transmutes the primitive simplicity of the form: the road itself is the greatest character in this novel of the road, and the hero's departures from the river and his returns to it compose a subtle and significant pattern. The linear simplicity of the picaresque novel is further modified by the story's having a clear dramatic organization: it has a beginning, a middle, and an end, and a mounting suspense of interest.

As for the style of the book, it is not less than definitive in American literature. The prose of *Huckleberry Finn* established for written prose the virtues of American colloquial speech. This has nothing to do with pronunciation or grammar. It has something to do with ease and freedom in the use of language. Most of all it has to do with the structure of the sentence, which is simple, direct, and fluent, maintaining the rhythm of the word-groups of speech and the intonations of the speaking voice.

In the matter of language American literature had a special problem. The young nation was inclined to think that the mark of the truly literary product was a grandiosity and elegance not to be found in the common speech. It therefore encouraged a greater breach between its vernacular and its literary language than, say, English literature of the same period ever allowed. This accounts for the hollow ring one now and then hears even in the work of our best writers in the first half of the last century. English writers of equal stature would never have made the lapses into rhetorical excess that are common in Cooper and Poe and that are to be found even in Melville and Hawthorne.

Yet at the same time that the language of ambitious liter-

It is this prose that Ernest Hemingway had chiefly in mind when he said that "all modern American literature comes from one book by Mark Twain called *Huckleberry Finn*."

ature was high and thus always in danger of falseness, the American reader was keenly interested in the actualities of daily speech. No literature, indeed, was ever so taken up with matters of speech as ours was. "Dialect," which attracted even our serious writers, was the accepted common ground of our popular humorous writing. Nothing in social life seemed so remarkable as the different forms which speech could take—the brogue of the immigrant Irish or the mispronunciation of the German, the "affectation" of the English, the reputed precision of the Bostonian, the legendary twang of the Yankee farmer, and the drawl of the Pike County man. Mark Twain, of course, was in the tradition of humor that exploited this interest, and no one could play with it nearly so well. Although today the carefully spelled-out dialects of 19th-century American humor are likely to seem dull enough, the subtle variations of speech in *Huckleberry Finn*, of which Mark Twain was justly proud, are still part of the liveliness and flavor of the book.

Out of his knowledge of the actual speech of America Mark Twain forged a classic prose. The adjective may seem a strange one, yet it is apt. Forget the misspellings and the faults of grammar, and the prose will be seen to move with the greatest simplicity, directness, lucidity, and grace. These qualities are by no means accidental. Mark Twain, who read widely, was passionately interested in the problems of style; the mark of the strictest literary sensibility is everywhere to be found in the prose of *Huckleberry Finn*.

It is this prose that Ernest Hemingway had chiefly in mind when he said that "all modern American literature comes from one book by Mark Twain called *Huckleberry Finn*." Hemingway's own prose stems from it directly and consciously; so does the prose of the two modern writers who most influenced Hemingway's early style, Gertrude Stein and Sherwood Anderson (although neither of them could maintain the robust purity of their model); so, too, does the best of William Faulkner's prose, which, like Mark Twain's own, reinforces the colloquial tradition with the literary tradition. Indeed, it may be said that almost every contemporary American writer who deals conscientiously with the problems and possibilities of prose must feel, directly or indirectly, the influence of Mark Twain. He is the master of the style that escapes the fixity of the printed page, that sounds in our ears with the immediacy of the heard voice, the very voice of unpretentious truth. □

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LETTERS

(Continued from page 5)

Massed Practice and Block Scheduling

I read with great interest your article "Allocating Student Study Time" (Summer 2002). It mirrored exactly what I and many of my colleagues have been saying for years. For those of us who have been around the block a few times (25+ years teaching experience), the concept of massed learning (which translates into "block scheduling") by its very nature goes against everything we've come to know about the learning of the human animal. I'm thanking you because you've given me one more round of arguments to wield against the advocates of block-scheduling in my school district. For years now, there has been a push to change to a block. I've yet to see any objective, scientific data to support this method of scheduling. Anecdotal evidence, such as "the kids like it," or "we're more relaxed," doesn't cut it for me, I'm afraid. Thanks again.

—TED C. DULUK

North Attleboro High School
North Attleboro, MA

—EDITOR

The cognitive scientist responds:

It is likely true that the distributed practice effects described in the last issue indicate that block scheduling will have drawbacks, *all other factors being equal*. The difficulty in applying research findings, of course, is that there are so many variables at play in the classroom. The longer periods in block scheduling could negatively affect students' attention and motivation, for example. However, it seems likely that teachers would not treat a 90-minute class as two 45-minute classes in succession; that is, they would teach differently under this different schedule. Research findings like the distributed practice effect have to be weighed in the context of other classroom factors, but on its own, the research on massed and distributed practice does indicate a cost to block scheduling.

—DANIEL WILLINGHAM

In July, researchers from Iowa State University and ACT Inc. released findings

from a six-year study of scheduling models that involved 450 high schools in Iowa and Illinois. The study charts the students' ACT scores (which indicate students' ability to do college-level work) from two years before the implementation of block scheduling to four years after. In the sample, 19 schools implemented a 4x4 block scheduling plan in which students took four classes (80 to 90 minutes each) per semester; 101 schools implemented an eight-block, alternating-day, full-year model in which students took four classes one day and four the next; and 330 schools maintained a regular, seven- to eight-period day. Overall, the results indicate that, at minimum, block scheduling is not a panacea. While schools that remained on a regular schedule had a small increase in their ACT scores, schools that switched to a semester schedule had a notable decrease in their scores during the first three years after implementation and a slight rebound in the fourth year. Schools that switched to an eight-block, alternating-day schedule remained about the same. To request a copy of the study, e-mail Don Hackmann at hackmann@iastate.edu.

Patriotism

In "Lincoln, Patriotism's Greatest Poet" (Spring 2002), a line was dropped from Abraham Lincoln's second inaugural address; as a result, the intended meaning of "The Sin of Slavery" has been compromised. In Lincoln's handwritten, prepared text, he wrote, "Yet, if God wills that [the Civil War] continue, until all the wealth piled up by the bond-man's two hundred and fifty years of unrequited toil shall be sunk, and until every drop of blood drawn with the lash shall be paid by another drawn with the sword, as was said three thousand years ago, so still it must be said 'the judgments of the Lord, are true and righteous altogether.'"

—WAYNE R. ARTHURTON

Webster, NY

Thanks to Mr. Arthurton for being such a vigilant Lincoln scholar. Readers can find the corrected sidebar online at www.aft.org/american_educator/spring2002/lincoln.html.

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