

**N**EAR THE University of Bologna—the world’s oldest, founded in 1088—is a medieval museum displaying carved memorial plaques that honor great professors of the past. “They all show the professor on the podium, with the students below,” says Thomas Forrest Kelly, Knafel professor of music. “Often the students are asleep, playing dice or cards, or fornicating.”

Much has changed since the Middle Ages, but one thing that persists is the lecture. The medieval university invented lecturing—the word comes from the Latin verb *legere*, to read—to cope with the scarcity of books: a lecturer would read the only available copy of a book to the gathering of students. “That was high technology in the thirteenth century,” says Kelly, “but not high technology for the twenty-first century!”

Now sit in one of Kelly’s lectures in his undergraduate course Literature and the Arts B-51, “First Nights: Five Performance Premieres” (see “First Nights,” January-February 2000, page 52). This morning in Sanders Theatre, he is describing the 1913 Paris premiere of Igor Stravinsky’s ballet *The Rite of Spring*. He does not

## Professor Video

**Visual, audio, and interactive media are transforming the college classroom.**

**by Craig Lambert**

read from books. Instead, Kelly punches up audio recordings of Stravinsky reflecting on the tumultuous performance, and projects color slides of oil paintings and photographs of the composer, plus photographs of the dancers and conductor Pierre Monteux. Next come pictures of the ballet’s score and the original costumes, plus paintings by Nicholas Roerich, the set designer. There’s another audio track of Stravinsky, this time disparaging the work of the choreographer, Vaslav Nijinsky, and a modern video of the opening dance performed by the Joffrey Ballet. Next, as the *Rite*’s primal rhythms and fierce dissonances thump and cascade through the loudspeakers, Kelly breaks down the piece into its musical units, walking the class through the score with a flashlight pointer.

The old-style classroom, grounded in spoken lectures and reading lists, is becoming obsolete. Images now dominate a new style of teaching in which visual, audio, and interactive formats rule, often trumping words as the dominant means of communication. Media enhancements aren’t exactly new: 50 years ago, one of Kelly’s predecessors, G. Wallace “Woody” Woodworth, prepared a 78-rpm record for a Music 1 class by taking a piece of blackboard chalk and marking an “X” on a groove at the entry cue. But new technologies, and a generation reared on them, are propelling the modes of teaching toward nonverbal media and briefer, more compact transactions. Communications—and pedagogy—are moving away from Tolstoy’s thousand-plus pages and toward Twitter, which limits its messages, or “tweets,” to 140 characters.





In the last two or three decades, Western culture has shifted its appetites toward images, film, and video. Word-driven media like newspapers are thinning out while video agoras like YouTube grow exponentially and threaten to eclipse even television. “The change has been so rapid that people and institutions haven’t been able to adjust,” says Shigehisa Kuriyama, Reischauer Institute professor of cultural history, who teaches in both the departments of history of science and East Asian languages and civilizations. “You have academic tenure, which works in a time frame of decades. Yet we now have technologies that are changing yearly.”

The student audience is primed. Thronging into classrooms is a generation saturated since early childhood with images and interactive media. Pictures, both still and moving, are their native vocabulary. “They don’t read books,” says Bernbaum professor of literature Leo Damrosch, who liberally lards his courses on humor and the Enlightenment with visual exhibits. “Even English concentrators finish high school having read *The Great Gatsby*, three or four other novels, and some short stories. I have three short novels on my reading list, and students ask, ‘What? Read a novel in a week?’ Many are not very good writers, either, and it is too late for Expos [Harvard’s required expository writing course] to fix it. Whenever I have had great writers as students, they were avid readers as kids.”

In the lecture hall, students multitask. With their laptops open to take notes, they’ll also monitor breaking news stories, check a fact on Wikipedia, and arrange their travel plans for the Christmas holiday. “They’re wired differently than we are,” says Rob Lue, professor of the practice of molecular and cellular biology. “This is such a digital generation that their expectations, in terms of multiple types of information input, are much different from ours. They are used to being on computers with multiple windows open. They research information on the Web and are connected to various social networking environments like Facebook. They play video games, so they’re accustomed to working in simulated environments. In some ways, as teachers we have not yet tapped that resource: their ability to work in created environments and learn from that experience.”

But faculty members are adapting.

► In Physical Sciences 3, “Electromagnetism, Waves, Imaging, and Information,” lecturer on chemistry and chemical biology Logan McCarty asks, “Why do we see colors on a soap bubble or oil slick?” and projects three examples of this phenomenon onto the screen in a Science Center lecture hall. Next, he draws annotations on a projected diagram of wave-interference patterns while discussing light wavelengths and the Huygens principle. Later, the discussion segues into diffraction, and the screen pulsates with an animation of light waves propagating through a slit.

► In a lecture on Chinese communism, William Kirby, Chang professor of China studies and Spangler Family professor of business administration, uses color slides to show students how the quality of clothing deteriorated when party leaders switched from Shanghai to Russian tailors.

► In his course on “Wit and Humor,” Damrosch screens clips of British comedian Eddie Izzard performing his transgressive, quasi-surreal standup act; later, he projects a B. Kliban cartoon of a large hole in the ground, titled, “The Nixon Monument,” and toward the end of the hour, runs a 10-minute film clip called *Il Mostro*, with Ital-

ian actor Roberto Benigni, to illustrate repetition and *double entendre* in physical comedy.

In Kuriyama's General Education course, "Medicine and the Body in East Asia and in Europe," students each week make brief (90-second- to two-minute-long) videos, or audio podcasts, instead of writing response papers. They post them on the course website the night before their section meets, view each other's work, then discuss the videos and podcasts in sections. (The final course project can be a written term paper, a video, a podcast, or a PowerPoint-style presentation; less than 30 percent of the students opt for the traditional term paper.) "The technological revolution that's happened means that you don't need expensive equipment," Kuriyama says. "You can make video clips with a digital camera, or a cell phone, or the webcam on your computer. The things that used to require expertise and specialized equipment are now accessible to everybody.

"There is no question that students spend much more time on these [weekly video/audio] assignments than they would on writing a short response paper," he continues. "First, it's more fun. Second, it is no longer just for the professor, but a place where you can show off for your classmates—it becomes this kind of friendly competition. You can see what other people have come up with, and incorporate that into your own next video—the students teach each other. We've found that the repetition of the exercise is really beneficial: as you work on it, you make better videos. Yes, you could have other students' response papers available—but you don't read them, that's a chore."

The new media aren't just a new way to teach the same things. New ways of recording and expressing information change what a researcher can see and discover, and so change the knowledge base—the content of the discipline itself. They also challenge some hoary precepts of academe, like the ideal of "pure" dispassionate intellectual work. In Kuriyama's Gen Ed course, for example, the students commonly add musical soundtracks to their video presentations. And "music raises the whole question of the role of affect in intellectual life," Kuriyama says. "Video with music has a powerful emotional component. That can be controversial, because there is a tradition of eliminating affect from academic life—the idea that emotion clouds the understanding. But with cultural history, true understanding has to include an affective understanding as well as intellectual grasp. The 'feel' of a period is essential to understanding what it was like to live in that time."

"WE'RE AT THE BEGINNING of a new age in how we teach," says biologist Lue. "Fifteen years ago, when I talked about this [visual pedagogy], few of my colleagues embraced it. That has changed. You will see a lot of visualization tools used at any sci-

entific meeting—when, for example, you discuss a model with other biologists. It allows you to communicate swiftly, and it's not just the speed, but the level of sophistication you can get across."

A field like biochem-



istry, for example, often involves assembling many discrete bits of data into a holistic, coherent model of a life process—say, how genes and their protein products support a complex phenomenon like hormone signaling. For this kind of modeling, a lab tool like electron microscopy, valuable as it is, "doesn't show motion over time," Lue explains. "It's a frozen snapshot of a dead cell." In contrast, the videos he uses show processes in motion; they represent particular models of how these processes work. "We'll stop the video and discuss it," he says. "It is not about students just swallowing it whole—it's a critical process."

To enrich both teaching and research, the Howard Hughes Medical Institute (HHMI) has supported Lue in directing the development of BioVisions ([multimedia.mcb.harvard.edu](http://multimedia.mcb.harvard.edu)), which aims to combine "the highest quality multimedia development with rigorous scientific models of how biological processes occur." The BioVisions eight-minute film *The Inner Life of the Cell* has become the most-downloaded science animation in history. It uses sophisticated 3D software developed in Hollywood animation studios like Industrial Light & Magic and Disney's Pixar to portray complex life processes like polymerization and intracellular signaling in a breathtaking visual display that ushers the viewer right inside the cell walls. "Until recent years, only someone like George Lucas could do things like this," Lue says.

"We are essentially opening a window on a world that we don't have the tools to see with our eyes," Lue explains. "Multimedia is the perfect way to set up the interactions of multiple players within that cellular environment. Scientists create visual models in their heads, and now we have the tools to share those models with students. It takes years for a scientist to develop the skill of



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keeping all those contingencies in mind—that’s synthetic thinking. I’d love to get students started earlier on it.”

With support from HHMI, Lue has studied three pedagogical aspects of BioVisions animations: retention of basic facts, ability to interpret new data and to integrate them into a coherent model, and the motivation to learn. Lue’s study, to be published within the next year, compares animations and storyboards to textbook learning. The use of animations resulted in significant gains in all three areas, especially in the capacity for synthetic thinking. Motivation to learn also increased by more than 25 percent. “This is a very serious matter for me,” Lue says. “There is a tendency to think, ‘These animations are seductive, but are they really making a difference?’”

HUMANS, of course, have always learned through their eyes. “Understanding itself has never been exclusively verbal,” says Johnstone Family professor of psychology Steven Pinker, who has written extensively about the brain and its functioning. “We’re primates, who are visual creatures, with a third of our brains devoted to vision. In the chalk-talk days, students would be forming images in their minds, especially when the subject matter was spatial—the anatomy of the brain, timelines in history, hierarchical organization charts. The use of visual images to teach allows us to tap into visual representations without the mediation of words. It’s not as if we didn’t do this before, but now we’re doing it more effectively.”

In his own teaching, Pinker uses visuals extensively. For example, a computer animation that shows how the intricate structures of the human ear transform sound waves into electrical nerve impulses is so powerful that Pinker says, “As a professor, I understood the mechanism of hearing for the first time.”

Biologist Mary Beth Saffo, RI ’03, says there are three reasons to use visual illustrations in teaching: to make things memorable, to clarify a concept or discussion, and to foster interactive learning. “You don’t own something until you have wrestled with it somehow, like writing a paper about it,” says Saffo, a science project officer at the Derek Bok Center for Teaching and Learning from 2007 until 2009 (she is currently an adjunct scientist at the Marine Biological Laboratory in Woods Hole). She cites pedagogical research showing that 15 minutes after a lecture ends, students typically recall 10 percent of its content, “but that becomes 90 percent if they had to work with the concepts.”

Historian Laurel Thatcher Ulrich agrees. With or without visual elements, “Big lecture courses are not the most effective way to teach,” she declares. “I don’t think passively receiving material does it. You want them to work with actual historical evidence and arrive at conclusions. People learn when they *do* something.” Accordingly, the 300th Anniversary University Professor uses an elaborate website ([www.courses.fas.harvard.edu/~hsb41](http://www.courses.fas.harvard.edu/~hsb41)) to define tasks for her students in Historical Study B-41, “Inventing New England.” The site, for example, takes students inside an old farmhouse where they confront an Endicott chair and have to figure out if it really is 200 years old.

In Ulrich’s course, the students read fiction alongside history; a novel like Nathaniel Hawthorne’s *The House of the Seven Gables* (1851), for example, explores the history of the titular house, built in the late seventeenth century. “We looked at historical materials from the seventeenth century to see how a nineteenth-century writer

recast that early history,” Ulrich says. “People use objects to create an image of the past.”

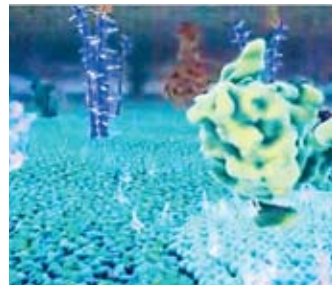
For her course on the American Revolution, Ulrich posts raw historical data on a website: offering, for example, a town-by-town Massachusetts tax inventory for 1771. “You can look up the percentage of taxpayers who owned sheep in each town in 1771,” she says. “That’s important because they were boycotting British woolens. We’ll ask students this fall: which towns are able to support the boycott? You can link the data to towns that had spinning meetings to promote the boycott.” Posting such data engages students with interactive media, but isn’t necessarily visual; words and numbers still work alongside the new options, albeit in an online format. The information may describe your great-grandfather, but it no longer comes in the hardcover, clothbound book he would recognize.

When Ulrich arrived at Harvard from the University of New Hampshire in 1995, she “was shocked that nobody was using anything visual. Harvard has been slower to pick that up. Nobody was doing websites or e-mail. Years ago, the Instructional Computing Group helped me build a custom site—it’s a shock to change from those really razzle-dazzle websites. Now, you automatically get a website when you set up your course, and there’s a standard template. Regardless, it is more work to set up an effective illustrated lecture: you have to find the right images and get it all to work together.”

“The thing most faculty are struggling with is creating that [visual/audio] material,” says Kuriyama. “Most of them are using things created by other people, but if you create your own media, that is very powerful. The big shift now is from still pictures to video, incorporating sound.” Kuriyama, who does create original video to show in his lectures, notes “an important distinction between film and video. Film is an analog medium, but video is a digital medium, so you can play with it, edit it, upload or download it easily. And economically there is no comparison: video is far less expensive.”

The media revolution means new skills to acquire for faculty members, who are already hard-pressed for time and want to know, say, if the start-up cost of learning a new piece of software will be justified. The 2008 book *Born Digital* by John Palfrey, Ess librarian and professor of law, and Urs Gasser, executive director of the Berkman Center for Internet and Society at the Law School, describes the generation of young people who have grown up with digital technology. Referencing this work, Alexander Parker, Ed.M. ’96, director of research computing in the humanities, observes that today we often see “students who were born digital, and faculty who were born analog. You sometimes have a situation where students have a greater facility with these tools than the faculty do.” This fall, under the auspices of Diana Sorensen, dean of arts and humanities, Parker is organizing four “tool talks”—“by faculty, for faculty”—on new media at the Barker Center.

Visual and interactive pedagogy “work pretty well,” says Ul-



Visit [harvardmag.com/extras](http://harvardmag.com/extras) to watch the BioVisions film, “The Inner Life of a Cell,” the most downloaded science animation in history.

rich. “We have a very visually oriented group [of undergraduates] out there. But they are not necessarily savvy at *analyzing* visual images. They absorb it, they’re used to it, they expect it, but it sometimes fades into the background like wallpaper. I’m trying to make them more aware of the things they constantly consume. You have to teach people to *look*.”

INDEED, IF IMAGES and soundtracks are the future of pedagogy, then teaching the young to *look* must become a high priority. This is yet another area in which technology has outpaced the human capacity to cope with it. People believe—complacently—that they know how to read, but can they really *see*? Engaging with images in a sophisticated and critical manner is an uncommon skill, even among the younger generation that has grown up with them. Educational institutions have evolved an advanced verbal culture, but sounds and images occupy a far more primitive academic habitat. Librarians deploy powerful tools, for example, for cataloging books and words, but the intellectual technology for classifying images lags far behind. Professors of the future will need not only to expose their classes to pictures, but to teach students how to question them.

Perhaps no Harvard professor has taught more students to look thoughtfully at their surroundings than John Stilgoe, Orchard professor in the history of landscape development, who for decades has expertly deployed visual media, especially photographs, in his celebrated courses on the North American built environment and landscape history. He began using slides in his lectures in 1977, when “outside of fine arts, I was the only guy doing it.” Today Stilgoe personally owns 150,000 slides, many of which he made himself with a Rolleiflex square-image camera.

Yet Stilgoe knows well that pictures also harbor dangers. It is “really easy to manipulate people with images,” he warns, “if you don’t tell them the context, or where an image came from.” To illustrate this point, he shows students a sequential series of his own photographs. The first picture depicts a purely bucolic landscape—a cornfield at sunset. The next image is the same scene, shot from 10 paces further back: now we see grass and a wire fence in front of the cornfield. Ten more paces, and the foreground includes a curbstone. To frame the final photograph, Stilgoe walked across the lanes of an interstate highway; seeing it, he says, “You realize that the cornfield is right next to a truck stop.”

Understanding images frequently requires knowledge from outside the frame. A professor at the Fashion Institute of Technology once helped Stilgoe date a photographic portrait simply by observing, “Given that hat, it has to be after 1923.” Scholars who lack such skills can go off on wild-goose chases. A colleague once asked Stilgoe to help her date a photograph; she had worked for a couple of years on an analysis that depended on the date of 1932 inscribed on its back. When Stilgoe observed that there was a 1934 Ford in the background of the picture, the scholar’s art-historical argument instantly collapsed, and she began to cry in Stilgoe’s office. “She thought she had no way of dating the picture by its content,” he explains.

Furthermore, academicians sometimes attempt to analyze images that they don’t have the background to understand. Stilgoe once attended a conference presentation that included several black-and-white photographs of Conestoga wagons headed west. Afterward, he asked the presenter if he realized that those images

did not date from the 1870s and 1880s, but were pictures taken at twentieth-century centennial celebrations in Midwestern towns, with modern people wearing period costumes. The speaker spurned this view until they projected one of the slides and Stilgoe pointed out a utility pole on the far right of the image.

“There’s no point,” Stilgoe adds, “in using images simply to dress up something that doesn’t need them.”

“IT’S ALWAYS BEEN true at Harvard: you have to have a good show,” says Leo Damrosch. He cites Baird professor of history Mark Kishlansky, who once observed that “All of us became better teachers once we got to Harvard,” because the student audience sets such a high standard.

In this regard, “The Q *Guide* is very powerful,” Damrosch asserts. That annual summary of undergraduates’ course evaluations “doesn’t ask what you learned—it’s all about performance. And performance is important: a teacher who drones on is not doing his or her job. It’s also possible to take a shallow course and goose it up with lots of visuals and prance around the stage with an affect that students like, and attract a big enrollment and a high Q rating. That doesn’t signify a good course.”

Tom Kelly agrees. “There’s something unattractive about trying to draw students with surfaces and bells and whistles,” he says. “I’ve taught in colleges where professors would put up big posters to attract students, because their department budgets were based on course enrollments. That’s the beginning of having students decide what a college education ought to be. Student satisfaction is important, but students are most satisfied when they’ve worked hard and taught themselves something—the teaching is really done by the student. Attractiveness and entertainment are fine, but they’re not the purpose of the course.”

Entertainment value is clear in Damrosch’s “Wit and Humor”—and visual elements often are the very material under study. “The way you respond to visual humor is much different from the way you respond to verbal humor, which requires decoding,” Damrosch explains. “In a humor course, it’s essential to move back and forth between the verbal and the visual.” Sometimes a verbal pun can be reborn as a visual one.

Visual media, with their rich endowment of stimuli, have a head start in evoking humor. “Verbal humor is unbelievably difficult to create,” Damrosch notes. “To make people laugh with nothing but words on a page—no actors, costumes, or visual elements—is a rare trick. The humor course assigns a text and a film each week for 13 weeks. If you took away my 13 texts, I could not replace them; if you took away my 13 movies, any one of us could come up with 13 films that would work just as well.”

In his course on the eighteenth-century novel, Damrosch also screens movies. “Most of those novels have been filmed,” he says. “It’s a huge asset to show film clips.” It allows the class, for example, to view the 2005 version of *Pride and Prejudice* starring Keira Knightley and ask, “Why did they make it more of a Charlotte Brontë romance than the kind of controlled, austere, ironic story you get in Jane Austen’s text?” Damrosch explains.

“The language of movies is just so different from literature,” he adds. “I don’t think there’s ever been a great novel that made a good movie. A *bad* novel can make a good movie—it becomes a kind of scaffolding. But take something like *Les Liaisons dangereuses* [the 1782 French epistolary novel by Pierre Ambroise Fran-



çois Choderlos de Laclos], which I consider the greatest novel of the eighteenth century. There have been repeated attempts to film it—for example, a [1988] version that starred Glenn Close and John Malkovich. It's god-awful; it truly is a terrible movie. Every single student can see that the novel is so disturbing and amoral—the characters are so predatory, in a society with no immune system. The novel is told in letters, and you never know if the characters are telling the truth—are they taunting each other, or caring, hurt, and jealous? All you've got is their words. As soon as you put actors in the roles, it can't stay ambiguous any longer, because you're looking at their faces, their body language.”

William Blake, on the other hand, wanted his poems always to be read with the relief etchings he made to accompany them, and “the picture often contradicts the word,” says Damrosch. “Most think of the poem, ‘Tyger! Tyger! burning bright’ as a poem of religious awe, but the picture Blake made to accompany it shows a smiling pussycat, which seems to contradict the language. Those who only know the text from reading it in an anthology have no idea what Blake wanted to do with it. He was *suspicious* of religious awe; Blake was a very lucid thinker. It has been assumed that you could teach these works just as poems, but that violates Blake’s intention—those images are not just illustrations, like in *The Pickwick Papers*. You need binocular vision to see Blake’s picture and poem together. If you cover one eye, you’ll miss the point.”

PITFALLS ACCOMPANY BRACING opportunities as the digital era, with its visual powers, steadily percolates its way into higher education. For example, the density of content that a tool like PowerPoint (now giving way to Keynote, which allows users to

drop in audio and video tracks far more easily) makes possible can overwhelm an audience. “A scientist at a blackboard is always writing things down at a pace the students can take notes on and understand,” Mary Beth Saffo explains. “But when you are flashing a slide on a screen showing material the students have never seen before, you have to give them time to absorb the concept before going on to the next one—especially in fields where one concept builds on another.”

Some will worry about the penetration of entertainment technology—and entertainment values—into higher education, as has already happened in politics, sports, and journalism. But Homer and Dante also sought to entertain. Without a show there is no audience, and with no audience, there is no learning. “Harvard is an institution that trains future professors,” says Kuriyama. “The students of *our* students will also be the consumers of their scholarship. All of them have grown up on YouTube. Unless you can connect with them, you have no audience.”

Some faculty members now eschew lectures entirely; they can provide the lecture material as readings or podcasts and gather the class together in a lecture hall purely for discussion. That format doesn’t work for Tom Kelly and the 300 students in his “First Nights” course. “I put on a show,” Kelly says. “I play the piano, I cue up CDs and pictures and slides, I mark up scores on the overhead projector in real time with red and blue markers. I once had a staff person volunteer to put all the slides and music on one DVD—I could just push buttons! But that completely misses the point. If I don’t have to run across the stage to play the piano, and trip over the cord on my way to the overheads, and bump into a table when I’m running to the computer, half the production values are lost!”

“If 300 students all come to Sanders Theatre at the same time on Tuesday and Thursday mornings, you’ve got to give them value,” he continues. “My course is about performance and the experience of performance in real time. Each year we commission an original piece of music for the course, and it is performed for the first time at the final lecture. These students are the only ones in the world to have heard it. They write papers on the performance and I take a bouquet of those papers to the composer, who usually says, ‘No one has ever paid this much attention to my music before.’”

Screens and digital technology launch a whole range of learning experiences that weren’t available even a decade ago. Still, the ultimate criterion of visual learning isn’t the visual, but the learning. If these media expand awareness and knowledge, then they enhance education; if they only draw attention to themselves, they become a distraction or even an obstacle. And although these technologies themselves will someday become obsolete, the student-teacher relationship will not. “There’s a feeling you get in a class—you can tell when students are catching on,” Saffo explains. “It is something you cannot get from a computer screen. I like to see the whites of their eyes.”



Visit [harvardmag.com/extras](http://harvardmag.com/extras) to watch a clip from Tom Kelly’s “First Nights” lecture on the boisterous premiere of Stravinsky’s “Rite of Spring.”



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