Quit Surfing and Start "Clicking": One Professor's Effort to Combat the Problems of Teaching the U.S. Survey in a Large Lecture Hall

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TEACHING AN INTRODUCTORY SURVEY COURSE in a typical lecture hall presents a series of related obstacles. The large number of students, the size of the room, and the fixed nature of the seating tend to maximize the distance between instructor and students. That distance then grants enrolled (usually first- or second-year) students enough anonymity to skip class too frequently and offer only limited attention when there. The advent of wireless Internet service has compounded the problem by bringing lecturers into competition with Facebook and other Web sites that have a high potential to absorb student-viewers, and thus seem to offer more significant distraction than texting, or its predecessor, note-passing. Seating charts, mandatory attendance policies, banning laptops, even roving teaching assistants can force order and mannerly classroom behavior, but usually at the cost of a collegial atmosphere, and without ensuring that those with nothing left to do but pay attention will do so, let alone engage in the material. Long before the term "active learning" gained caché, I developed a teaching style that relied on discussion and occasional in-class exercises, as did many of my colleagues. For those of us who depend upon class participation, this lack of engagement lies at the center of our dissatisfaction with how the survey class is taught at most large public universities. Discussions and questions posed mid-lecture invariably engage only a handful of "smart" and/or confident students

who do not mind speaking in front of a hundred (or more) strangers. The majority of students who do not fall into these categories often see this element of a lecture as something that does not concern them, or worse, a waste of time, and wait passively until the "real" material (i.e., that which will appear on the test) starts up again.

In the spring of 2004, a publishing representative introduced me to classroom response systems (CRS), alternately referred to as audience response systems, personal response systems, classroom response technology, electronic voting machines, "clickers," and a host of similar names. This wireless classroom technology allows every student to respond with handheld devices to multiple choice questions posed by the instructor, most commonly via PowerPoint and a projector, though some programs pose the questions in other formats. All transmitted answers are picked up by a receiver connected to the instructor's computer, whose software then allows two things to happen. First, the instructor can immediately display a histogram that represents the aggregate responses to the question, and later, s/he can discern how (or whether) individual students answered. Thus clickers both allow instructors to engage the entire class in participation, and provide records of who is attending class and more or less paying attention. The most typical use is to intersperse a number of questions (usually between four and six) throughout a lecture, though other uses include reading quizzes, tests, and games. Despite the fact that I am not generally inclined to embrace new technologies (at the time, I still used an outline on an overhead projector rather than PowerPoint presentations, and I have not yet developed a Web site or employed a Web-based class management system), my frustrations with large survey classes made this innovation appealing, so I adopted it for two sections of "U.S. History to 1865" in the fall of 2004.

Since then, my encounters with CRS have left me with a good deal of knowledge, mostly positive, about the systems and their use in large enrollment courses. Between 2004 and 2008, I have: a) used three different classroom response systems over the course of six semesters (Interwrite PRS, Turning Point, and eInstruction); b) participated in a task force that evaluated all such systems then on the market and ultimately recommended one (eInstruction) that my university standardized on, and; c) completed two years of a three-year pilot project designed to test the efficacy of clickers in large classrooms, sponsored by my university's Quality Enhancement Plan (QEP). My own classroom experiences, as well as a growing body of evidence from non-history users of this technology, points to several advantages.[1] Implementing a CRS component in a large lecture course improves attendance, increases class participation, and generally makes lectures more enjoyable for students, by their own report. But to my mind,

the most important effect is on the teacher. The process of crafting the best questions before class and determining how to respond to the variation in student answers during class makes it more likely that I will recognize and address gaps in students' comprehension and reasoning well before the test. Because they fit with my teaching style and goals, clickers promote my ability to help a broader range of students think like historians, and with better success than I encountered with lecturing, limited class discussions, and essay tests alone.

The following overview of my experience with clickers in a U.S. history survey course points out potential pitfalls and highlights what has been helpful in the larger audience response system literature. This literature is at somewhat of a remove for historians because the vast majority of CRS adopters (and thus most published studies) have been in the hard sciences, especially physics, engineering, and medical education, where different teaching methods, chiefly application and problem solving, dominate.[2] Nevertheless, as will be clear below, some of their insights about the best sort of questions to ask and how to ask them have come to influence my own approach. My relative success in using clickers to teach critical thinking skills occupies the second part of the essay, including a brief case study of my strategy in teaching slavery at the survey level.

Early reports about—and my own experience with—CRS were mixed. Like most adopters, I found that students enjoyed "clicking" both for its novelty and because they liked participating and getting credit for it, though they resented the cost and interruptions brought by technical difficulties. From my end, I shared typical instructors' rewards of improved attendance (with "clicker classes" having as much as six percent higher attendance rates) and a more engaged classroom.[3] But unlike physics or statistics professors who could use the system to see if a majority of students could solve a problem based on a recently explained formula or concept, and then make a decision to move forward or not, I did not immediately see a corollary within the history lecture. In other words, it was not clear that the benefits outweighed the downsides of technical difficulties, cost, and what initially seemed to me a somewhat circumscribed number of uses in a typical history classroom. For the most part, I can now report improvement in all of these areas.

Not surprisingly, dramatic technical innovation offers the clearest example of improvement. Whereas the first classroom networking systems had to be hard-wired and installed by educational institutions themselves—making them expensive and uncommon—by 2004, when I began, wireless technology permitted individual instructors to adopt the system without any cost to (or approval by) the college or university.[4] CRS suppliers usually provide receivers free to instructors of large classes,

knowing that enrolled students are then required to purchase the clickers (alternately referred to as response pads, transmitters, keypads, handheld devices, or remotes). In my first semester with CRS, the transmitters sent infrared (IR) signals, which had to be picked up by receivers permanently mounted on the walls at the front of the classroom. Too many responses sent at the same time jammed the system, and fluorescent lighting occasionally caused interference (begging the question of whether there existed a university classroom without fluorescent lighting), all of which resulted in slow assembling of student responses, with each question often taking several minutes of class time. Though acquiring and learning the basics of the software presented few problems, some tasks proved frustrating. In particular, for the first two systems I used, the procedure by which the instructor linked the identifying number for each student's clicker to the class roll was not intuitive; my mistakes meant that I spent a good deal of time collecting information about attendance and participation by hand when it should have been easily tallied by the program. Software improvements have resolved most (but not all) problems concerning roster creation, and in any event, I have found technical support for higher education users to be helpful and (usually) quick. Most importantly, radio frequency (RF) technology has replaced the problematic IR devices in large classrooms. RF clickers have indicators that inform students whether their answers have been received, do not require the installation of bulky receivers, and never jam. Setup time is minimal (less than five minutes before class) and even very large classes can see histograms of aggregate responses almost instantly upon the end of polling.[5]

The improvement in transmitter technology mirrors the rapid change in CRS technology overall, and for the marginal technophobes among us, this has a troublesome as well as benign side. Instructors can count on new iterations of software regularly, as well as redesigned hardware. One system (Interwrite PRS, recently merged with eInstruction) offers a robust clicker that allows a variety of question formats, including short answer, as well as a homework mode. This company has also recently introduced the use of laptops or PDAs as "virtual clickers" which can be used in classrooms with RF clickers. Appreciable differences between competing systems exist as a result, and prospective adopters of a CRS system are advised to spend a bit of time getting informed, rather than just accepting the report of a publishing or CRS representative. Once users have adopted a particular system, they may find keeping abreast of technical advances takes time, but can improve the classroom experience. Users are not obligated to adapt to each new innovation, however, as all the companies I have dealt with have continued to support older models of hardware and previous iterations of software.

A problem related to technological innovation—students' complaints about cost—has not been as easily resolved, but a number of issues have mitigated their expenses. The retail price of clickers depends on the system, as some companies charge more upfront for the transmitter, while others add a per-semester registration fee to a lower-priced response pad. On average, the cost to students ranges from $35 to $50 a semester, though occasionally, publishers offer rebates to those who purchase new texts.[6] While costs have risen slightly, more widespread use means a decrease in the cost-per-course, as long as all the courses are using the same system—if not, students find themselves purchasing and carrying multiple brands of clickers. To avoid this expensive proposition, and to make a campus-based support system feasible, many universities, including my own, have chosen to standardize, and then pressed faculty to adopt only that system. At this time, my participation in my university's QEP project has solved the cost problem altogether; an institutional grant supplied my department with 150 clickers which I distribute and collect at the beginning and end of each class. Though I was initially concerned that this process would be confusing and time-consuming, that has not proven to be the case. Distribution and collection takes a few minutes, and it solves the problem of students' forgetting or losing clickers, or refusing to buy them altogether. Before we supplied clickers, the average number of lost, forgotten, broken, or never-purchased clickers ran about five to ten percent each class.[7]

Although insights I can offer about overcoming technical and financial obstacles are helpful, they are less important than what I have learned about how best to use CRS to improve survey-level teaching. Given that the "problem solving" application commonly discussed in the math and science CRS literature did not at first translate for me, I initially embarked on a less ambitious approach. Oftentimes, I asked "icebreakers" to get students involved and/or interested at the beginning of class, and then stopped intermittently throughout the lecture—often after discussing a difficult concept or showing a film clip, but sometimes after ten minutes of straight lecture—to test their understanding and/or attentiveness.[8] These questions are embedded within my PowerPoint slides, so the process of displaying the question, allowing the students about thirty seconds to transmit their answers, finding out through the resulting histogram the percentage of right and wrong responses, and briefly explaining the correct answer to those who had missed it initially occupied only two or three minutes of lecture time.

A few examples should suffice. The opening/icebreaker question for my lecture on the Puritans asks students to identify which statement accurately reflected Puritan life, with the five multiple-choice possibilities referencing Puritans' 1) condemnation of alcohol, 2) preference for all-black clothing,

or 3) disapproval of sex in general, or reading 4) "all of the above" or 5) "none of the above." Reflecting popular misconceptions, most chose "all of the above," despite, of course, that Puritans drank, wore bright colors, and permitted "bundling." When the histogram appearing on the screen inevitably loads toward incorrect answers, I point out that that the vast majority of the students surely need the day's lecture because they have much to learn about Puritan life, a suggestion that is usually met with a bit of good-humored agreement.

On a slightly different tack, I sometimes seek the opinions of my students on philosophical or political issues related to the lecture material. These questions do not have a right or wrong answer, of course, but can illustrate the continued relevancy of a historical disagreement, help to explain how context shapes individual responses, or indicate the varied points-of-view within a classroom. Prior to my discussion of Alexander Hamilton and Thomas Jefferson, for example, I offer two different characterizations of the nature of humanity and thus the best role for government, based on the ideas of each man, keeping the philosophers unidentified. After students have voted on which one seems more accurate, I reveal that those who chose option one will likely find their political philosophy origins in Hamilton, and those who chose option two will perhaps identify more with Jefferson. Though on this occasion, the opening question is directly related to one of the lecture's major conceptual points on the relationship of contrasting philosophical outlooks to the political development of the new nation, I do not make such a connection a priority. Rather, I tend to use the first question to hook interest with "fun facts" or contemporary associations.

The questions I pose at intervals throughout the lecture require analytical thinking a bit closer to "comprehension" and "application" rather than "recall" (to use Bloom's taxonomy). Recall questions can tell me who is paying attention or is keeping up with reading assignments, as well as remind students that I will now have a record of their lapses. But more challenging questions that ask students to apply information in a new context are more engaging and instructive. After explaining the concept of Southern honor, including the role of dueling among social equals as a means of maintaining one's reputation, I ask them to imagine themselves as a planter who must decide how to respond when hearing that his overseer had insulted the virtue of the elite man's wife or daughters. If their first impulse is to pick the "challenge him to a duel" option over "thrash him with a cane," I know I need to spend a bit more time emphasizing the importance of social status in the Old South. In a similar vein, an exercise in which I masquerade as a law school professor requires me to explain Chief Justice John Marshall and his Federalist principles and priorities,

give the facts of a series of important cases, and then use clicker questions to challenge students to ascertain Marshall's decision in each one. Those who have committed to an answer and discovered it incorrect are generally more engaged in hearing an explanation of why, allowing me to explain more carefully the Federalist world view.

As I considered how to broaden this dynamic with my lecture—and, not coincidentally, simultaneously attended a series of teaching workshops on active learning as part of my obligation to the university's QEP—I discovered that immediately disclosing the correct answer missed an opportunity. The software can lead an instructor in this direction, and in fact, one program I used was not even equipped to give credit for right or wrong answers unless the correct answer was marked at the time the question was written, that is, before class. But as I learned more about the principles of active learning and peer instruction (and how best to use new CRS software), I recognized that delaying my intervention brought significant benefits.[9] Now when a histogram indicates that a majority (or even large minority) of students answered incorrectly, I stop lecture for three or four minutes, and ask the students to consult with their notes and one another, and then repoll. At this point, I may ask groups who voted a particular way (for the correct answer or not, depending on what I think will be more helpful) to explain their answers, or I may try to get such explanations from those who have changed their votes from the first poll to the second. Eventually, assuming there is a right answer (more on that below), I will clarify that for the class, often employing in part the words supplied by a classmate.[10]

Allowing the class to discuss questions takes more time, and means that I have to omit some content, but my experience and the scholarly literature tells me it is worth it. The short discussion periods offer students an opportunity to instruct one another, and to start working with the material while still in class. Educational theorists going back to Dewey have recognized the importance of responding to learners' needs but, more directly, several studies of the efficacy of clickers have found that students are more likely to work out a problem if first asked to do so in class. When they do not understand a new concept, they may be able to learn it more easily from a peer who has just figured out for him/herself and may use a more familiar vocabulary. Moreover, they become more comfortable with expressing their own problems with a concept, in part because they can see others are in the same predicament, and in part because there is so much classroom chatter (at that point) anyway. Students ask more questions, and better questions, and the quality of discussion improves as a result.[11]

Emboldened by the possibilities of such discussions, I began to include more questions that depended on historical interpretation, and so did not

have an indisputably correct answer.[12] The fact that history relies on skilled interpretation of imperfect evidence is a major theme in my course, and for several years, I have pressed this point in a somewhat infamous lecture on Bacon's Rebellion, where I refuse to clarify what caused it, and what (if anything) made it important. Along with confronting the conflicting answers to those questions on Web sites, in textbooks, and by listening to my synopsis of several different historians, students observe contradictions in assigned primary sources from Nathaniel Bacon, Governor William Berkeley, Robert Byrd, and others. During class, I pose a series of clicker questions that ask students to discern the "right" meaning of a few of these sources, and to decide what is the most accurate explanation for a key issue, such as why so many frontier residents joined Bacon's army. Because in this instance they must eventually write a short essay adequately supporting one of the several theories I have presented with the primary source evidence at their disposal, I offer little resolution after these debates (with the promise that I will not leave so much up in the air in any future lecture, as long as they remember that every lecture could conceivably be as open-ended as the one on the 1676 conflict in Virginia). More often, however, I offer a clearer explanation of what causes historical interpretations to differ, and why I find one option more convincing. After a presentation on the Whiskey Rebellion, for example, I may ask them to assess whether the event represented a victory of the Federalists or continued liberalism in American political views. Here the answer is both, depending on how one weighs various aspects of the Whiskey Rebellion and its aftermath, a point many arrive at once they begin to try to persuade their discussion partners of one answer over another.

Beyond the satisfaction that comes from witnessing introductory students debate such matters, this process often highlights my students' need for assistance in developing their critical thinking skills. When they stumble over an issue such as the relative conservatism or liberalism of an event like the Whiskey Rebellion, I step back, and model how I would approach such a question—settling on a definition, creating categories, and systematically going through the evidence.[13] Again, this takes more time away from content lecture, but I believe it has improved the quality of essays I have received and has the potential to endow some students with skills they desperately need.

While most instructors who use CRS believe it helps students understand complicated material better, hard evidence that clickers promote the development of such skills or other student learning outcomes is difficult to come by. To date, few have even attempted to implement appropriately rigorous research designs, and those that *have* recognize the implicit difficulties in attributing any gains to one source (the use of clickers) over

other possible explanations.[14] In response to continuing questions about the benefits of active learning strategies (and to satisfy the Southern Association of Colleges and Schools reaffirmation process), my university embarked in 2007 on an ambitious, three-year project to discern which active learning strategies work best, and in what sort of environment (from large lecture halls to small seminars), and with what sort of students.[15] My part in this project is to teach two sections of the same introductory history course, using clickers in one (the experimental section), but not the other (the control). The research committee has devised a series of tests and surveys to track students' progress, attitudes, and effort, compiling reams of data in the attempt to distinguish which achievements come from the different teaching strategy, and which are explained by differences in differences in SAT scores, age, commitment and interest in the course, etc. Unfortunately, this commendable if exhausting thoroughness has not yet overcome all the barriers to assessing the added value of clickers, and may not ever do so. After completing the second year of the study, we could confirm that attendance is better with clickers than without, even when attendance is taken in both classes. Further claims about the effect of clickers on critical thinking skills are provisional at best.[16]

All the same, the last year of research on teaching has left me with a good deal of anecdotal evidence and suggestive data. A case study on the impact of clickers on my presentation of the history of slavery offers a brief illustration. Because the topic of slavery comes relatively late in the semester, I insist that students be prepared to develop independently a position on a (somewhat simplified version of a real) scholarly debate about antebellum slavery. Over the course of two lectures and a class-wide discussion of Frederick Douglass's *Narrative*, I set forth two competing explanations for how slaveowners maintained control—through the mutual development of a paternalistic relationship with their slaves or by commanding brute force over them. I note that over the years, historians have legitimately differed on the relative importance of these internal and external factors in maintaining slaves as a profitable labor force. For one of their final exam questions, I expect students to be able to provide competent support for one position or the other, or to explain how shifting contexts made one more common than the other. Clicker questions and small and large group discussions in which students try to convince one another of the meaning of some of Douglass's stories help students figure out how to organize and interpret their data.

My research associate, Gregory Kosc, compiled student responses to a set of questions we asked in the fall of 2007, looking for evidence on the effect of clicker questions and discussions on student views over the course of a class period. Did students answer the same question (about

the influence of paternalism) at end of the second lecture differently from when they had at an earlier instance? He then compared those responses to their exam performance, to ascertain whether, or how well, a perspective gained over the course of a clicker-based discussion session shaped their final analysis. Though the size of the pool was small (twenty-three) due to our requirement that all students had the same grader (me) and wrote on the same topic, the correlations were significant. Of the twenty students who attended both lectures, one-quarter (five students) did not reflect any alteration in outlook, but three-quarters (fifteen) did. Of the fifteen students who at some point changed their minds during the discussion or before the final, eleven showed such a development while in class, apparently in response to clicker questions and post-question discussions; four did so between the lecture and taking the exam, perhaps reflecting on a remembered exchange, though it is equally likely the change was the result of some other instruction or influence. Of the eleven who gained a new understanding during class, only one still went on to write a mediocre final essay that lacked a clear conceptual handle on the issue, suggesting that the discussions helped students understand the dimensions of the debate and how to marshal the appropriate evidentiary support for one view over the other. Determining the impact of the clicker method on the five students whose exams and clicker responses were always the same is more difficult. The absence of movement may have emerged from a solid confidence in their own understanding of the concept and evidence from the beginning, or it may have been the result of their decision to push a button without thinking, and refusing to engage in the thinking I was asking them to do. My suspicion is the latter, as only two of the "non-changers" wrote capable essays with appropriate levels of evidence, argument, organization, and conceptual understanding on display. Though the other three were in class and responding to questions, apparently nothing I did helped them to understand what was expected of them, or otherwise motivated them to figure it out before the final. Such students suggest the limits of clickers to intervene in student learning. On a more positive note, four of the five best-written essays came from the group who were present and (apparently) engaged; of the three students who missed a lecture and their fellow students' discussions, two wrote dreadful essays.

Even if I had much stronger evidence for the efficacy of clickers in improving student achievement in the survey class, I would not suggest that every instructor rush to adopt them. Whether or not this pedagogical strategy is worth implementing depends on a number of factors. The first involves the nature of your institution's students. One study aimed at assessing the appeal of CRS for students who typically refrain from participating (represented heavily by foreign and female students) found

that most non-participators report a positive experience. The one group in the study who did not like clickers, however, were those who believed that all instruction needed to come from teacher/experts and who resented being required to attend class when such was not the case.[17] Schools characterized by a high proportion of such traditional learners may find clickers a difficult sell, while those with large numbers of students who are uncomfortable participating may find a transition to them easy. In my own experience, those who were most strident in their expression of dissatisfaction with the system (apart from issues of cost or technical difficulty) were those who liked talking in class and were often good at it. They both missed having the same opportunities and resented the fact that typical non-participants got credit for participation. (As one evaluator who "hated" clickers explained, "I don't need participation help, and my test scores speak for themselves."[18]) In a similar vein, like any instructional reform intending to reach a broader cross-section of students, especially those who lack sufficient preparation for the critical thinking expected in college, the risk of losing the interest of the best student increases. I have not had significant complaints on this score yet, in part because my analytical approach is novel to most students, but I remain wary of oversimplifying course content. Those with well-prepared students may find this potential trade-off too costly.

A second major element of deciding on whether to try clickers depends on one's strengths as an instructor. The classroom is intermittently chaotic, and instructors have to have the force of personality or discipline to keep a rein on that chaos. Moreover, they need to be ready to respond when students' discussions occasionally spark a new direction. Those new to the classroom in particular may be less welcoming of the opportunity to address what their students want to know, as opposed to what they are prepared to tell them. On the other end of the spectrum, those seasoned instructors who regularly keep students transfixed with their superior lecturing capabilities would probably find dealing with these issues counterproductive, unless they are looking for new challenges or are concerned about particular lapses in student achievement.

For my part, I have found that clickers have suited my strengths as well as my teaching goals. I cannot state categorically that my students are smarter or even happier since I have introduced this technology, but I do think I am a better survey-level teacher. Certainly, student performance on tests had long demonstrated their gaps in knowledge and organizational and analytical skills, gaps I would try to fill after the fact, before the next test or with the next batch of students. Now, I can intervene before lame essays disappoint us both, and have the pleasure of beating out MySpace for my students' attention in the process.

Notes

1. One compilation of the early literature on implementation of classroom response technology notes that of twenty-six studies, most report "greater student engagement (16 studies), increased student understanding of complex subject matter (11), increased student interest and enjoyment (7), heightened discussion and interaction (6), increased student awareness of individual levels of comprehension (5), and increased teacher insight into student difficulties (4)." See Jeremy Roschelle, William R. Penuel, and Louis Abrahamson, "The Networked Classroom," *Educational Leadership* 61, no. 5 (February 2004): 52. For a more in-depth literature review, see Carmen Hedwig Fies, "Classroom Response Systems: What Do They Add to an Active Learning Environment?" (Ph.D. diss., University of Texas, 2005), 10-44. More recently, all of the authors collected in David A. Banks, ed., *Audience Response Systems in Higher Education: Applications and Cases* (Hershey, PA and London, U.K.: Information Science Publishing, 2006) testify to increased student attendance and participation and the impact of CRS on the instructor's inclination and ability to intervene in critical thinking skills.

2. A review of the specializations of the authors in Banks, ed., *Audience Response Systems in Higher Education*, and a compilation completed by Charles R. Graham et al., "Empowering or Compelling Reluctant Participators Using Audience Response Systems," *Active Learning in Higher Education* 8, no. 3 (November 2007): 236, indicate that the most common fields are physics, computer science, education, engineering, physical science, psychology, and accounting. I have found two case studies by political scientists [Danny Damron and Jonathan Mott, "Creating an Interactive Classroom: Enhancing Student Engagement and Learning in Political Science Courses," *Journal of Political Science Education* 1, no. 3 (2005): 367-383 and Robert Webking and Felix Valenzuela, "Using Audience Response Systems to Develop Critical Thinking Skills," in *Audience Response Systems in Higher Education: Applications and Cases*, ed. David A. Banks (Hershey, PA and London, U.K.: Information Science Publishing, 2006)], and one in philosophy [S. A. J. Stuart, M. I. Brown, and S. W. Draper, "Using an Electronic Voting System in Logic Lectures: One Practitioner's Application," *Journal of Computer Assisted Learning* 20, no. 2 (April 2004): 95-102], but none in history.

3. In the fall of 2007, I taught two sections of the U.S. survey, each with approximately 120 students. One section used clickers and one did not. The clicker class had a statistically significant six percent increase in attendance. Attendance was taken in both classes, and participation required in both; the clicker class had 83.4 percent attendance over the course of the semester and the non-clicker class had 76.8. In the fall of 2008, the same protocol was observed. Disparities in attendance rates were not statistically different in this year, but the patterns of attendance still demonstrated the ability of clickers to keep students coming to class. Chronic absenteeism (more than 30 percent absences) was very rare in the clicker class, but there were three times as many cases in the control/non-clicker class. Anonymous end-of-term evaluations regularly included comments about how clickers "kept us paying attention," "made things interesting," and were "cool." In each class where students purchased clickers, about three to six percent protested the "ridiculous" cost or otherwise noted that the cost outweighed the benefit. Course evaluations from 2004 to 2008 are in possession of the author.

4. For an overview of the evolution of this technology since the 1970s, see Ray A. Burnstein and Leon M. Lederman, "The Use and Evolution of an Audience Response System," in *Audience Response Systems in Higher Education: Applications and Cases*, ed. David A. Banks (Hershey, PA and London, U.K.: Information Science Publishing, 2006).

5. eInstruction claims up to 1,000 responses can be calculated instaneously ("Classroom Performance System, Radio Frequency," <http://www.einstruction.com/Products/CPSRF/index.cfm>), while Interwrite PRS claims their technology permits up to 2,000 responses ("Interwrite PRS" <http://www.einstruction.com/products/assessment/prs/>).

6. Though payment structures differ, two models suggest the typical approach: eInstruction pads cost about $22, with a per-semester use fee of about $13 for the first three semesters of use (and thereafter registration is free); Interwrite PRS pads cost approximately $55, but do not require registration or user fees at any time.

7. Quintin Cutts, "Practical Lessons from Four Years of Using an ARS in Every Lecture of a Large Class," in *Audience Response Systems in Higher Education: Applications and Cases*, ed. David A. Banks (Hershey, PA and London, U.K.: Information Science Publishing, 2006), 75-76 shares my assessment of the advantages of school-purchased CRS kits rather than individual student-purchased clickers. These kits work in at least two different ways: In one type, instructors create a roster with each student assigned a specific numbered clicker which s/he picks up from the kit before each class; in another type, students may use any clicker in the kit, but must enter their own identifying number before starting class. While the benefits of not relying on students to purchase clickers are significant, it bears mentioning that such a purchase represents a substantial investment (approximately $5,300 to $8,000 per 150 students).

8. Eugene Judson and Daiyo Sawada, "Audience Response Systems: Insipid Contrivances of Inspiring Tools?" in *Audience Response Systems in Higher Education: Applications and Cases*, ed. David A. Banks (Hershey, PA and London, U.K.: Information Science Publishing, 2006), 30 note that "lecture pacing" is a typical first method of using classroom response technology.

9. The best source here is Eric Mazur, *Peer Instruction: A Users Manual* (Upper Saddle River, NJ: Prentice Hall, 1996). An interesting assessment and review of the educational benefits of active learning methodologies highlighting CRS specifically can be found in William R. Penuel, Louis Abrahamson, and Jeremy Roschelle, "Theorizing the Transformed Classroom: Sociocultural Interpretation of the Effects of Audience Response Systems in Higher Education," in *Audience Response Systems in Higher Education: Applications and Cases*, ed. David A. Banks (Hershey, PA and London, U.K.: Information Science Publishing, 2006), 188-201.

10. Scholarship on peer instruction divides on the best procedure. Mazur advocates getting students to make an individual commitment before breaking down into pairs or groups to discuss the problem. R. J. Dufresne et al., "Classtalk: A Classroom Communication System for Active Learning," *Journal of Computing in Higher Education* 7, no. 2 (March 1996): 3-47 maintains that discussion with the whole class and then small groups should proceed polling. Engineering instructors who tested the benefits of both procedures leaned toward the former, but suggested that the best process depends on the complexity of the problem, with the most complex issues requiring "class-wide talk" prior to polling. [See D. J. Nicol and J. T. Boyle, "Peer Instruction versus Class-wide Discussion in Large Classes: A Comparison of Two Interaction Methods in the Wired Classroom," *Studies in Higher Education* 28, no. 4 (October 2003): 457-473.] Perhaps because of the size of my classes and the nature of my questions, I prefer Mazur's individual response—then small-group discussion of responses—then repolled question method.

11. See S. W. Draper and M. I. Brown, "Increasing Interactivity in Lectures Using an Electronic Voting System," *Journal of Computer Assisted Learning* 20, no. 2 (April 2004): 81-94; Louis Abrahamson, "A Brief History of Networked Classrooms: Effects, Cases, Pedagogy, and Implications," in *Audience Response Systems in Higher Education: Applications and Cases*, ed. David A. Banks (Hershey, PA and London, U.K.: Information

Science Publishing, 2006); Judson and Daiyo; Webking and Valenzuela; as well as Nicol and Boyle for further discussion of the appropriate educational theory and studies linking CRS to critical thinking achievement.

12. Charles Anderson and Kate Day, "Purposive Environments: Engaging Students in the Values and Practices of History," *Higher Education* 49, no. 3 (April 2005): 319-343 contends that instructing students about the practice of history and especially historians' imperative to weigh evidence are central concerns pressing for the creation of interactive lecture halls.

13. For the most part, my strategies for modeling historians' critical thinking skills are of my own devising, but I have gained valuable advice and suggestions from Charles Bonwell and James A. Eison, *Active Learning: Creating Excitement in the Classroom* (Washington, D.C.: School of Education and Human Development, George Washington University, 1991) and Thomas A. Angelo and K. Patricia Cross, *Classroom Assessment Techniques: A Handbook for College Teachers*, second ed. (San Francisco, CA: Jossey-Bass, 1993).

14. The most common findings of studies about the benefits of CRS are listed in note 1 above. One of the few studies to make a serious claim for the ability of classroom response technology to improve learning outcomes using a rigorous research design is Neville W. Reay, Pengfrei Li, and Lei Bao, "Testing a New Voting Machine Question Methodology," *American Journal of Physics* 76, no. 2 (2008): 171-178. Another study by Reay et al., used a control and experimental model to prove that students, especially female students, in the experimental classroom with clickers performed better on conceptual questions on tests—see Neville W. Reay et al., "Toward the Effective Use of Voting Machines in Physics Lectures," *American Journal of Physics* 73, no. 6 (June 2005): 554-559.

15. For information on UTA's QEP program, "Active Learning: Pathways to Higher Order Thinking," see <http://activelearning.uta.edu/qep/qep.htm>.

16. Personal communication with Vice Provost David Silva, University of Texas at Arlington, August 15, 2008 and February 26, 2009. See note 3 for attendance statistics.

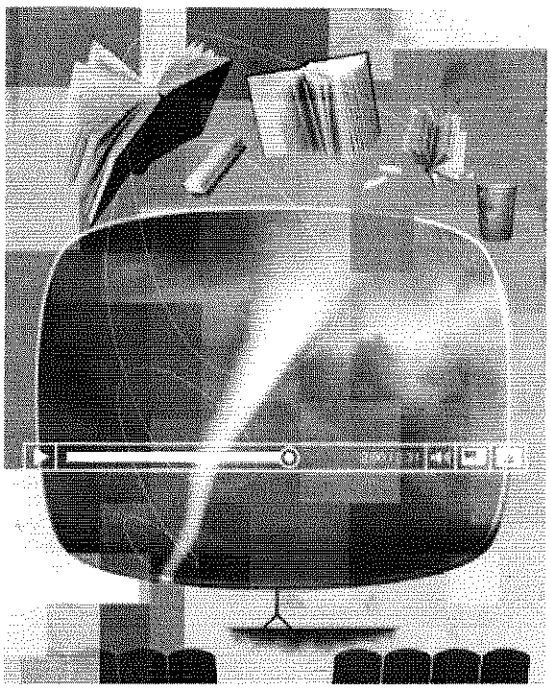
17. Graham et al., 243-251. In my own evaluations, both views have been expressed. One complained that the instructor should "just lecture and hold me responsible for the material." More common is the sentiment that clickers were "cool" because they made class "interactive rather than just lecture." "The majority of class is allowed [to participate]," another noted, "and likes to be involved."

18. Evaluation in possession of the author.

HARVARD MAGAZINE

Published on *Harvard Magazine* (http://harvardmagazine.com)

Professor Video



[7]

Illustration by Stuart Bradford

Keywords

faculty [11], film [12], higher education [13], pedagogy [14], technology [15], undergraduate education [16], video [17]

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

Craig Lambert [5]

HM Multimedia [9]

See "Teaching with Video [10]" for a trailer for Kuriyama's class, a video Lue uses, and a video of Kelly teaching. Listen to student podcasts submitted for Kuriyama's class.

Near 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," [18] 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 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 Italian 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."

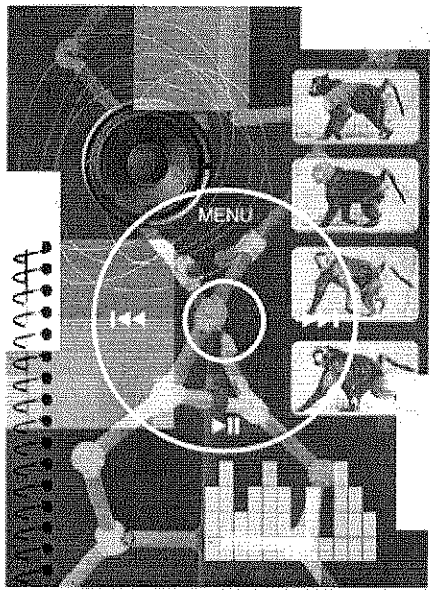


Illustration by Stuart Bradford

"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 scientific 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 biochemistry, 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 [19]), 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 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 [20]) 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 Ulrich. "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."

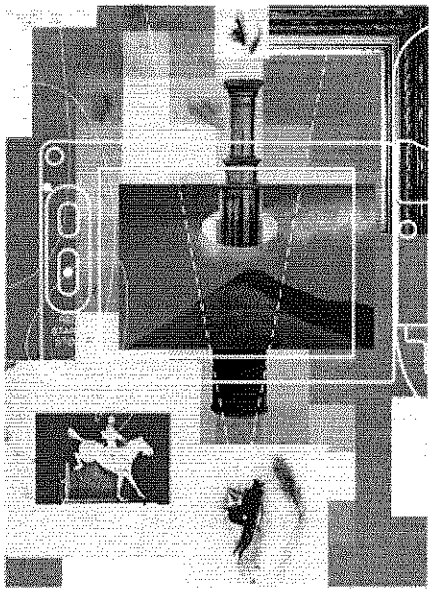


Illustration by Stuart Bradford

"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 François 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."

Craig A. Lambert '69, Ph.D. '78, is deputy editor of this magazine.

http://harvardmagazine.com/2009/11/new-media-transform-college-classes