

Cohabiting W I T H COMPUTERS

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How will university life change in our computerized future? What human traits will resist the pressures of automation? Dr. Spinrad presents his view of things to come in the form of three episodes in the lives of the Student, the Professor, and the Administrator.

IN 1967 JOHN PIERCE, then of Bell Telephone Laboratories, in introducing a report to the President's Science Advisor observed that, "After growing wildly for years, the field of computing. . . appears to be reaching its infancy." Remarkably, a decade and a half later, the same thing can still be said.

This should not surprise us because, by its very nature, this incredible technology is open-ended, having no natural or logical limits to its utility. Programs build upon programs in a pyramid of value, each new layer providing increasingly rich tools and services. Some have likened the introduction of computers to the introduction of movable type in its effect on the social body. I find myself comfortable with that analogy, and am not at all reluctant to predict substantive changes to the essential workings of a university impacted by computers.

But my crystal ball is, alas, cloudy as to the *exact* shape of things to come. I have decided, therefore, to present my vision to you in the form of three vignettes: The Student, The Professor and The Administrator. These scenes are set in the very near future.

The Student

Rod walked into his dorm room, threw his book bag on the floor, flopped down at his desk and checked his mail.

Junk, junk, junk. The usual collection of announcements, trivia, on-line arguments and general trash. He disposed of them quickly.

But about a dozen items down the displayed list something caught his eye. The Swingtime Jazz combo was doing a gig that night at the Lion's Den, 9 o'clock. He'd be able to go. Great!

Humming to himself he flipped through the rest of the messages. A note from Paul about a borrowed disk. A Spring Fling had been scheduled. OK. He'd think about that—maybe Sara. A Humanities outing to the Met. OK. Junk, junk. He flicked the pointer down the screen. And then, wouldn't you know it, the very last message was labeled "Warning."

He read it quickly. It was from a guy in his AA 107 class, addressed to the whole class. He didn't know this Fred very well—chatted with him a few times at class breaks. Anyway, here was Fred, in a friendly note, saying that old Henderson had pulled a fast one on them. The assignment, instead of being the usual no-brainer, was very, very heavy. Fred wanted to alert everyone to that just in case they were thinking of leaving it to the last minute, which was just what Rod was planning on doing. Damn, damn, damn.

He pulled the assignment up on the screen. It looked innocent enough. "Read the first three sections of chapter 4." He glanced at his desk; yes, the book was there. "Read Henderson's Class Support Notes (5)." ("Class Support Notes"—that was a laugh. Old Henderson was just practicing on the class for his new book.) "Write a comparison of

Nozick's proposition with Taber's." Oh boy. There it was. Rod saw the jazz concert fade away.

He pulled the Class Support Notes up on the screen and started to read through them. It was a long text; a paper copy would be better. He punched the "hard copy" button and walked down the hall. By the time he got there the printer had produced the last page. Seventeen pages—damn! Rod riffled through the notes; there were diagrams, too! He reflected on what to do next, and quickly decided he'd go to dinner. On the way back from the service cluster he passed his room and threw the notes on his bed.

Thursday night was steak. At least that was good. On the way down he met Art and told him about Henderson's assignment and how it was going to screw up his evening. Art gave him one of those supercilious upper-classman smiles and asked him whether he had forgotten about the Student-Lib file system, an outgrowth of the old Fraternity File system. He had, in fact. He typically didn't use those files because there were sloppily organized and maintained. But this was different, and Art was right; that was the place to try. Rod bolted his dinner (even though he liked steak) and quickly returned to his room.

Student-Lib files were peculiar things. They contained old course material, class notes, random copies of old exams, student term papers, odds and ends. There was no money to maintain them—no Information Coordinator to keep them in shape—so they were structured only by the automatic data management programs the university kept around as utilities. Certainly a far cry from the professionally managed data and document bases that students and staff were used to. Nevertheless, there were times when they could be useful, and this was one of them.

Rod browsed through the file, cursing the weak, machine-generated cross-referencing schemes. It took him easily three or four times as long as usual to zero in on what he wanted, but find it he did! Three years ago Henderson had given a somewhat similar assignment. Fortunately, two students (probably nerds) had filed their essays. The

automatic programs had picked up some of the keywords and so Rod was able to find the reports.

He read their analyses on the screen (they were short enough that it didn't pay to make a hard copy). Then, alerted to the important points, he read the chapter sections and the Support Notes.

It was 6:45, and the concert was at 9:00.

Was this "cheating"? Rod didn't know. But if it was, it was certainly part of an old tradition. And anyway, hadn't he heard once that it didn't matter how you got the ideas in your head, as long as you got them there?

Rod started typing. He had been using keyboards since he was a child and his fingers flew over the keys. He'd heard that, in the old days, veteran reporters prided themselves on being able to type faster than they could write. Of course; it seemed funny now that it had ever been a question.

About halfway through he stumbled. What was that Rawson demographics model? (He thought that it would look good to refer to it, and, feeling slightly guilty about this tawdry motivation, he decided to really learn something about it.)

He put the half-finished report aside (placing a tiny pointer to it at the corner of the screen) and called up the Rawson model. Now there was a retrieval system! Just a few keystrokes and the model with necessary tutorial text was on his screen. Where did it come from? Was it in the University library files or did the system have to reach farther for it? Rod wondered about that for a few seconds and then decided that it didn't really matter.

He worked with it for a little while, got the idea, and then applied it to his own data. He had spent more time than he thought he would, but it was actually fun. (He'd have to look up some more about this fellow Rawson.)

7:45. He thought he'd make the concert.

Back to the paper. Dismiss the Rawson model. Pull back the half-completed text.

He began going a little slower, thinking more about what he was saying and, for that matter, what old Henderson was

really after. He actually looked up a few things he didn't absolutely have to. (It was easy enough, he rationalized; a few keystrokes and he had it.)

But then, sensing that he was reaching the end, he swung into full student-glib mode. Rolling phrases, extravagant similes and then—a full four minutes on the last sentence—he was almost through. But not quite. It would hardly pay to submit a slightly illiterate text, so he passed his paper through the service the students called RUF—the writer's friend.

RUF—with the artificial friendliness and somewhat cloying deference of a "human interface system"—pointed out "some possible spelling errors" and a few syntactical "abnormalities." It highlighted three places in the text where Rod might want to check his grammar. Of course, RUF was right. Rod made the suggested changes and a few others. And he was done.

He filed it (properly dated and identified) and sent a copy to the Henderson class submission file. He made a hard copy for himself just so he could carry it around. He felt good about it.

8:30. Plenty of time. He checked his mail again. This time he found a message from Laura. It seemed like a kind of personal thing to put on the electronic mail system. He read it through a second time and erased it.

Was there an admission fee for the concert? He called the announcement back up on the screen and was pleased to see that it was free. Out the door, Rod.

The concert was great! Even though it had been set up at the last minute, the electronic word had traveled fast and there was a big crowd. After a couple of encores the crowd spilled out into the quad a little after 11:00.

At 11:45 Rod checked his mail for the third time that night. He was tired but what he read really aggravated him. Some clown was claiming—and to a broad distribution list—that the University should stop subsidizing the Sunday band concerts in the quad. What an idiot! Didn't the guy understand anything about social values? He quickly typed a

somewhat inflamed reply to the same broad audience—and sent copies to the band members.

“Let’s see what they say about that,” he thought as he fell onto his bed.

The Professor

Henderson arrived at his office shortly before 1 o’clock after the usual round of Saturday morning errands. Walking across campus from the burger joint he thought again about Ryad’s article, the one he’d read last night. There was something disturbingly important lurking in that bland scholarly text, with all its footnotes and expansive explanations. It would be all too easy for someone to skim it and toss it aside, missing some of the quietly revolutionary things she’d said. (He smiled at the intellectual baby fat of this young postdoc. It just takes time to have enough confidence in yourself to be able to write directly and to the point without all the scholarly trappings.) Well, he’d help.

Sitting down at his screen he quickly typed a brief message calling particular attention to the article and dispatched it to the group of his colleagues most interested in this area—about 70 people at various institutions around the world. It was simple: in the “To” spot of his electronic mail form, he just typed “Positionist Group” and the system took care of the rest, looking up the names of the group members, determining how to reach them, and transmitting the text.

In the old days such a thing just wouldn’t happen. One could hardly imagine coming into one’s office in the morning and making 70 phone calls to colleagues suggesting that an article might be worth reading. Or writing 70 letters. Or writing one letter and sending out 70 copies. No. The effort involved would clearly signal the action as suspect, or at least odd. But, with the electronic mail system as effective as it now was, such a friendly note was quite routine—normal and collegial—just because it was so easy and straightforward.

But he hadn’t come in to do that. The only reason he and his wife had put off driving to the cabin until tomorrow was

that he had to catch up on some things and, most importantly, prepare all of next week’s lectures. He was going to be so tied up that this was the only day he had. (Of course he could have handled it all from his home workstation, but he’d really wanted to get out of the house. Hadn’t exactly told Jane that.)

Fortunately, Henderson had taught this course many times before so it wasn’t as if he had to start from scratch. He pulled up his lecture notes from the last time he’d given the course, two years ago.

Well, maybe he was getting lazy, as Jane said, but it looked as if, for the most part, they’d do. They needed some updating, and he’d do a better job on the new material, he rationalized, because he could build on the base already established.

Current. Relevant. Topical. That’s what he was after. He wove some recent news clips into the illustrative material, picking some particularly striking color shots. The TUTOR program, an old standby of his, made it easy to structure and display the lectures. With only a modest amount of advance notice to the library, he could present an astonishingly diverse array of materials on the classroom screen—pictures, charts, models, even animation (although Henderson didn’t use this much). The lecture outline, of course, only appeared on the screen at the podium.

Just as he was starting on the outline for the Friday lecture he was startled by the phone’s ring. It was Dean Croft. Henderson started to mention his surprise that the Dean was there on Saturday but then thought better of it. (Deans, too, have a lot of work to do, apparently.)

There had been a complaint from a parent and Croft had been given an earful that morning. While the Dean was talking, Henderson swiveled in his chair and brought the student’s file up on the screen—a kid named Rod Jackson. An erratic record. Periods of excellent performance interspersed with lackluster ones. Something was wrong. He was embarrassed that he hadn’t noticed it himself. He stared at Rod’s picture but was troubled to find that he couldn’t place him clearly in the freshman class he taught.

Henderson and Croft had a long and somewhat inconclusive conversation. The professor agreed to speak to the young man and, when Croft hung up, he sent Rod a message asking him to drop by his office. Henderson stirred up a cup of coffee and wondered whether the University, with all its wondrous communications modes, wasn't neglecting the most essential one!

Well, back to work. He did a more thorough revision of Friday's lecture, allowing a greater amount of time for discussion (was that a coincidence?) and for a brief profiling of the people involved.

Completing his preparations, Henderson notified the library's Resource Scheduler to expect heavy student demand for a file he knew to be located across the country. (The scheduling algorithm would decide whether to establish a local copy for the high-use period.)

He pulled up the homework assignment forms, filled them out and dispatched the message to the class, along with a personal note. (The earlier conversation still preyed on him.) Edgy, he decided to go out for a walk.

One turn around the campus and he returned to his office refreshed.

There was this idea for a paper he'd had—just notions flitting about in the back of his mind. He'd been looking forward to browsing through the literature in the field. Start with a key contributor—Junko. Henderson typed in the name and was rewarded with a list of Junko's articles for the last four years.

Selecting one, he called it to the screen and started reading. No. Not the area he was thinking about. Try another. Yes, closer. This was interesting and promising. He didn't bother following up on the first and second references but the third seemed, for his purposes, to be more important. He pointed to it on the screen and the article, after a short delay, appeared. (Where had it come from? He guessed only the librarians could track that one. No matter.)

The new article led to another one which, in turn, led to a third. Thoroughly engrossed, Henderson didn't notice the passage of time.

The third article talked about a "Hammersmith Community." What was that? No references were provided. Henderson highlighted the term and asked for a search. The pause was a bit longer this time, but a list came back. He dug in, burrowed around and, to his surprise, came out in somewhat unfamiliar terrain. So he reversed the direction of his intellectual zoom lens and asked for a broader, rather than a narrower, context. Again, the system obliged, although not as helpfully. (Specific to general is harder to program, his computer science friends told him—at least so far.) It took a lot more browsing before he was comfortable with the material he was getting. (Fortunately, the system was keeping a road map of his search. That way later, if he wanted, he could reconstruct the thread through the diverse articles in the various journals that all played on the Hammersmith theme.) Finally, he tried a few "fuzzy searches," but the sweep was too broad and he couldn't cope with the torrent of only slightly relevant information.

Enough for now—and quite a bit to think about. He was hungry and late. He called his wife, made apologies (she was resigned) and went out for a snack. (She agreed to make other plans.)

On his return he checked his mail. Nothing special since yesterday. One message was from a colleague in Taiwan (apparently sent on Sunday, which was tomorrow). The fellow was seeking some specific information about the recent United States/Japan codicil. Henderson pulled up the Department copy on his screen. It was heavily marked up (in an electronic sense). Some notes were his; others were pointers to comments by other people. There were even two voice annotations (shown by the little image of the telephone next to the paragraph). He touched one and smiled at the gruff, curmudgeonly voice; no one could ever mistake Watson. (For him you really didn't need the screen's name identification.) Yes, yes. Watson's view was clear and forceful, but no one in the Department would be particularly surprised at what he had to say. But no, nothing bore on the specific question.

Henderson thought it inappropriate to share any of his

colleagues' off the cuff comments with the Taiwan university so he cleared the screen copy of all its annotations, typed a cover message attaching the codicil and, apologizing for not having an answer to the question, sent it off.

He sent a copy of the original query to Torrey, the Department's Information Coordinator, asking whether he could help. He was careful not to send a copy of the second message to the Taiwanese because he didn't want to appear to be committing Torrey, who was always complaining about overload. You had to be careful about these things.

Now, one last task before he called it quits. The book he was editing was in its final stages. Hayes (always the last one) had finally transmitted his chapter, and the other authors were bleating about the delay.

He displayed the text in composition mode and began editing. He was mainly concerned with the material's appearance since the content had already been painstakingly reviewed. This was pleasing work. Henderson felt that he could understand the pride that printers took in the production of a truly handsome book.

Today, the screen obeyed the what-you-see-is-what-you-get rule, so he could savor the exact appearance of the final printed page, with the varieties of typefaces, sizes, and emphases accurately displayed. Further, the screen image faithfully duplicated the graphs, charts, diagrams, and pictures in their proper positions.

Editing, then, consisted of moving things around on the "page," changing sizes and positions until the image was attractive. The process was fun.

The advantage, of course, was that the electronic file behind the screen image was the master from which the book would be typeset. This eliminated typesetter's errors, saved considerable time, and was viewed by Henderson and all his colleagues as a great improvement over the way things used to be.

He stored the book file, awaiting only the *Acknowledgments* page, before he did the final touch-up and first run of copies.

It was 10:00 p.m. and, as Jane would impatiently say, he'd

"spent another day at his damn screen." But there were a few things to clean up.

He triggered the calendar program to try to find a meeting time for the curriculum committee. He sent a voice message to his mother. He read the minutes of the last meeting of the Faculty Senate.

Then, just for fun, he retrieved the University's electronic bulletin board. Ads. Rides to share. Protests. Causes. Jokes. Urgent pleas. Concert announcements. (He'd missed a good one last Thursday.) In a funny way you could take the pulse of the University by reading the bulletin board. Up. Down. Tense. Easy. The beat of the community flowed before your eyes on this glowing screen.

Funny! Henderson thought about the built-in contradictions as he closed the door of his office.

The Administrator

Dean Croft got in early after her run. There were mornings—and this was one—when she thought the answer to her overload problems was to beat the staff to the office and get a quiet headstart on the day. She checked her calendar. The blinking entries reminded her of things she had to do that day. (Some were "tickler" entries that either she or Dick, her assistant, had previously put in; others were automatically generated by the administrative calendar system.) Nothing out of the ordinary. Only two really time-urgent ones.

The first, sending out the research proposal to the Council on the Arts, she handled herself. The budget office had completed and filed the financial forms and tacked on the administrative boilerplate. She typed a cover message to the whole package (sufficiently gracious she hoped) and sent it off.

The second was a little touchier. The C-School Visiting Committee was starting its two-day session with a dinner that evening. She was scheduled to give the welcome and charge-to-the-committee talk, but Wriston still hadn't told her the outcome of that hot curriculum argument. She sent a note to Wriston, and a copy to her assistant, saying she

had to talk to him before 5 o'clock. Dick, seeing the message when he came in, would know enough to follow up—vigorously!

She took a quick look at the *New York Electronic Times* headlines and then went on to her mail. Oh, look at all that stuff. She'd unloaded the mail file last night before she left the office, but look at all the messages that had come in since! Some had been sent yesterday and had come in overnight, primarily from schools to the west. But the bulk of it was from local faculty and staff. (At times like this she considered the home workstations to be a mixed blessing. For a moment she regretted not having set the automatic mail sorter to send a polite response to some of her correspondents saying that the Dean "was away until Friday but would certainly reply as soon as possible." But she quickly squelched the thought. It was the responsibility of Deans (she mentally sighed) not to be "away until Friday.")

She scanned the list of senders quickly and chose to read—out of sequence—one from Sovenhower, the President. It seemed that the President, at the Trustees' dinner last night, had been asked to give a talk, two weeks hence, on "the role of the university as a catalyst for social change." Before he retired for the night and because he knew that "time was short," Sovenhower had sent Croft a message asking her to "work up some ideas." Surprise—and extra work—was, it seemed, an ever-present element of this job.

Croft decided on a two-pronged assault. First she sent a note, with the President's message attached, to her assistant and asked him to browse electronically through the Sociology Library database for relevant material. Dick was a well-organized chap and liked to operate the search programs; he called it "prowling the world's information thicket." And of course his "prowls" were aided by the multiple paths blazed—and the threaded trails left behind—by scores of previous scholars.

Next, she sent the message off to Torrey, the Information Coordinator. (No matter how smart those computer science folks were, they'd never produce a program that would replace the human mind for sorting, sifting, and recalling

ill-defined or poorly characterized snippets of information. Or at least Croft hoped that was so.) Torrey, she felt, would give the request more than casual attention when he saw its source.

The two probes launched, Croft entered a "tickler" into her calendar system and went out into the hall for the regular morning coffee-and-danish break.

She and Lee chatted about a facilities problem until her 10:30 budget meeting. It was just a week before the scheduled submission and a large group had assembled. Buchanan, the chief budget officer, summarized. This was the first year in the last three that there had not been some sort of financial crisis. She put the source and application of funds tables up on screen and touched on the key issues for each of the major entries. There were a lot of "what if" questions which she quickly explored on the displayed financial spreadsheets. Croft was old enough to remember when these kinds of manipulations took days—or weren't done at all because of their difficulty. How quickly new things became useful—and then necessary. Why, she could remember when students had had to stand on long lines to register for classes. How odd, to think of it now.

In those days, when computers were new to the university, the debate had raged about how to charge for them. Computer time and services were expensive. You couldn't just give them away, could you? So a variety of schemes had been developed to ensure that these valuable assets were properly paid for and efficiently utilized around the clock. Students, for example, were charged less and had more responsive services if they did their computer work from ten p.m. to six a.m. That made sense, didn't it? Faculty, for their part, battled over scarce research computer time.

Then, one day, some wag had written a piece for the student newspaper suggesting how to cut costs and make more efficient use of books at the library. The plan was simple: the University would time-share books, with readers taking turns throughout the day. The less privileged readers would, of course, be scheduled for the midnight-to-dawn shift but would be charged less.

The parody had had an electrifying effect. All of a sudden everyone understood! Computers and databases were to the twentieth century university what books had been to the sixteenth century one! Basically, people had to change the way they looked at things.

But the ensuing political battles had been fierce. They were only really settled when a wise university president declared the libraries to be the winners—but quickly added that all major new library expenditures would be for computing, database, and communications equipment. Since then, as is well known, the libraries had become heavily electronic.

It was funny, but a lot of the changes now taken for granted had been forced on the university by the students. Not in a '60s-type revolution but by an '80s-type one. In the '80s, freshmen had begun pouring into the universities with personal computers packed in with their jeans and stereo equipment. After putting up their posters, filling their drawers, and setting up their speakers they had looked around their dorm rooms for the computer jacks. But except in some pioneering schools, the information jacks hadn't existed.

For the fact was that these students, these children of the information age, were ahead of their elders in understanding the nature of the revolution that was taking place—the information revolution. And it was their impatience that—in no small part—pressed these new structures onto the somewhat stodgy university body.

It had been somewhat rocky at first, Croft remembered, but the young people were right. A colleague of hers once said that students were the "crabgrass in the Grove of Academe." But Croft knew better and she suspected that her colleague did also. Universities had to lead and, Croft ruefully acknowledged, more often than not the impetus came from the younger members of the traditional "community of scholars."

She was still thinking about change as she strolled toward the Faculty Club for lunch. Henderson had been talking about some ideas he'd been playing with. They looked very

promising and, with these new systems, you could chase things down so much faster than you could in her day. She'd actually, at odd moments, been learning how to run the new browsing searches. Dick, ever the enthusiast, had been eager to help, and was clearly pleased that his boss was so interested.

As she walked through the door she resolved to block out some time that afternoon to do a little browsing and thinking. Maybe, she thought, there were still a few years of good scholarship left in her old bones.

Epilogue

I hope, through these somewhat fanciful vignettes, to have given you a sense of what the future university might be like. But I must confess that writing them did not particularly stress my abilities as a seer since so many of the things I've talked about today already exist in one form or another. I have simply tried to weave separate threads into a pattern that could seem reasonable to you.

What literary qualities these scenes may lack will, I hope, be compensated for by the intensity of my conviction that these remarkable technologies will have a profound effect on all the ways of our lives. And that those who work with words and ideas will be the most affected.

I was first introduced to computers at this great university some 30 years ago. And I must tell you that I find myself as fascinated and excited by them today as I was on that very first magical day.