SESSION X

COMPUTER USE BY PSYCHOLOGY PROFESSIONALS

Mary Beth Rosson, *Presider*

The electronic spreadsheet as a professional productivity tool

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One focus of this paper is on the use of a personal computer and its applications programs as a professional productivity tool. The intent is to illustrate ways faculty can use computer technology in managing complexity and change in their professional lives. After briefly reviewing some conventional uses of personal computer applications programs, the paper describes techniques by which an electronic spreadsheet can be used to contribute to professional productivity. Examples illustrate the use of an electronic spreadsheet as a memory aid and tool in monitoring work habits and setting task priorities. A second focus is on the study of human-computer interaction. After suggesting the generality of certain phenomena, the paper describes some implications for research and for the design of computer applications programs.

Just as access to computing resources affects the instructional role of faculty members by creating new opportunities for the use of computers (Hewett, 1985, 1986, 1987), it can also have an impact by creating new opportunities for faculty members to use microcomputer applications programs in managing their professional lives. One obvious, but nontrivial, example is the impact of the word processor on the amount of writing one does, or on what one considers to be acceptable written work. When one has a word processor, there is no longer a need to worry about creating time-consuming extra work (e.g., retyping) by revising and re-revising. Although a word processor, in and of itself, does not guarantee an improvement in writing, it reduces much of the strain and pain involved in rewriting until one either is satisfied with the result or has run out of time. The real issue in deciding whether or not to own a word processor is not the amount of writing one does, but the amount of writing one should be doing.

Other examples of uses for a microcomputer applications program involve the electronic spreadsheet simulator (e.g., Multiplan, SuperCalc, VisiCalc, etc.). This kind of program was originally designed to simulate and replace the large paper worksheet used in accounting and financial planning. It is, however, a more generally use-

ful tool that can be used to study and explore functional relationships among a number of parameters. Consequently, it can be used in fields as diverse as ecology (e.g., Silvert, 1984), mathematics (e.g., Arganbright, 1984; Williams & Williams, 1985), psychology (e.g., Half, 1987; Hewett, 1985), nutrition, and physics.

An electronic spreadsheet simulator is oriented around a matrix of cells organized into rows and columns. The user can enter text, data, formulas, or instructions into any cell. The program then executes user-specified calculations automatically, after a new value is entered, or upon demand. This calculation cycle often involves recalculation of new values for previously entered formulas that depend upon still other values that may have been changed during or since the last calculation cycle. The typical spreadsheet simulator also offers a number of programming language capabilities, including the ability to manipulate strings and to do iterative calculations.

A FEW OBVIOUS USES FOR A SPREADSHEET

A gradebook developed using a typical spreadsheet program (e.g., Multiplan) can easily do standard calculations across a student's scores and across the entire class. In addition, it can calculate grade cutoff scores referenced to a numerical criterion, look up letter grades in a table, and assign them to a student based on the relation between the student's score and the cutoff scores. It can do this for each assignment or exam and for the total points ac-

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cumulated in the course. When passing back an examination, it is possible to provide students with statistics about their latest exam and about their overall grades up to that point in the course. All of this information is produced as a side effect of recording the numerical scores in an electronic gradebook that can also be used to print out a revised class and grade list at any time it is needed.

The ease of calculation made possible by the spreadsheet also means that time formerly spent on mechanical calculation of grades can be devoted to reassessing criterion scores and the work of borderline students. If the cutoff scores appear to be too high, it is quite simple to adjust the criterion, recalculate the cutoff scores, and look at the new grade distribution. Having established a satisfactory criterion, it is possible to spend more time reviewing the work of borderline students and deciding whether any of them are entitled to the benefit of a slight upward nudge to the next higher letter grade.

Another fairly obvious use for an electronic spreadsheet involves travel. When one is eligible for travel support, one can keep a blank copy of a spreadsheet template that duplicates the institution's travel expense report form. Upon returning from the trip, the traveler can enter the list of expenses from the trip expense diary into the appropriate places on the spreadsheet. Naturally, all calculations are performed by the spreadsheet program, so entry errors or omissions are easily correctable. It is then a simple matter to print out the information and copy it onto an official university form.

The savings here can be in terms of time and frustration. Filling out a travel expense report form by hand often requires recalculation of the totals or recopying of the information at least once. Sometimes, when the row and column totals do not balance to the same grand total, it may be necessary to recopy the form more than once. Not so with an electronic spreadsheet version of a travel expense report. Also, when one's expenses are being reimbursed by someone other than the institution, it is quite simple to use the spreadsheet template, modify it slightly, and print out the result as the accounting report to be filed with the request for reimbursement.

SOME LESS OBVIOUS USES FOR A SPREADSHEET

Some people, when not in the mood to work, have a great facility for not remembering how little effective working time remains before the scheduled completion date of a particular paper or project. Similarly, it is easy to be overly optimistic about how much work can be accomplished in a given time when promising to work on an interesting new project a few months hence, or when thinking about delaying work until an upcoming term break or holiday, especially if one has conveniently "forgotten" some unpleasant but necessary chores.

A Personal Gantt Chart

To avoid having more work committed than time available in which to do it, a spreadsheet program can be used

to develop a time and project management chart. This personal "Gantt" chart can also help one decide which projects and papers should be targeted for completion and which opportunities must be ignored or refused. For example, Figure 1 shows the screen of my Macintosh on one day of May 1987.

Organization of the schedule chart. The particular window shown in Figure 1 is labeled "Conference Schedule," but the spreadsheet is used to keep track of more than simply conferences. The top row and the first column are frozen in place, and the rest of the spreadsheet can be scrolled beneath them. The topmost cell in column one contains a mnemonic notation set, A,P,N,D,Pr, in which A stands for Abstract, P for Paper, N for Notification, D for Due, and Pr for Presentation. The rest of the cells in the top row contain a month-by-month listing of the remaining months of 1987, and on into 1988, off the screen. The remainder of the first column is devoted to several categories of conferences, projects, or papers. These categories include work in progress, work under review, and possibilities. For example, row 2 refers to a paper presentation made at a conference on Next Generation Information Systems. The paper was scheduled for presentation on June 11, a Thursday. Row 3 refers to a lecture given during a workshop at the National Educational Computing Conference (NECC), and row 4 to a set of notes due in England in late June for a tutorial conducted on September 7 at a conference on Human-Computer Interaction (HCI). The asterisks represent estimated preparation time, the time available in which to do the work, or some optimistic combination of both.

Rows 7 and 8 of the spreadsheet refer to papers under review. Row 7 is for a paper submitted to the same conference at which the tutorial was conducted. From the notation, one can see that notification of whether or not the paper had been accepted was slated for early May, with about 1 month available in which to prepare a final draft, in the event of acceptance. The conference itself was scheduled during the second week of September. Row 8 refers to a paper submitted for a conference in Germany during the first week in September. Notice that the organizers of the conference in Germany were late

Figure 1. A personal Gantt chart.

on notification of either acceptance or rejection of the paper.

Rows 11 through 15 refer to conferences or papers under consideration. For example, row 12 refers to the meeting of the Society for Computers in Psychology (SCiP), which was scheduled for November 5. The extended abstract was to be submitted by July 15, and, based upon previous experience, notification of acceptance or rejection was expected to arrive in mid-September.

Problems solved. One benefit of this chart can be illustrated by considering the potential conflict between acceptance of the SCiP paper and a decision to submit a paper for the conference referred to in row 15. Final drafts of both papers would have to be completed in October. Similarly, notice the potential conflict between preparation of an abstract for the SCiP paper, the final preparation and delivery of the tutorial notes, and the June NECC presentation. Of more importance for conducting long-term planning, however, were the preparation time and the September 21 submission date for the Computer-Human Interaction (CHI) conference referred to in row 14. Scanning down the column for September 1987 suggests that it would have been unwise to delay work on the CHI paper until September since it was possible that the first 2 weeks of September would be tied up with conferences in Europe. Effectively, the CHI paper deadline was September 1 rather than 21. Priorities must be established and choices must be made about how to spend one's time. Once a choice has been made, or once work on a project is completed, a paper or project can easily be moved from one category to another.

Further down the spreadsheet, although not visible on the screen, there are other categories—a list of papers in progress, a list of research projects, a list of software development projects—along with a provisional schedule for completion of each item. In addition, there are rows devoted to papers or projects completed, conferences or projects bypassed, and papers rejected. All of this creates a useful record for future reference. For example, it is easy to use information on regularly scheduled conferences to begin blocking out time on the schedule chart a year or two in advance by using approximate dates based on those of earlier years. Similarly, if a conference must be bypassed because the call for papers arrives too late for action or because there is a conflict with something already scheduled, it is quite simple to block out the time to prepare a paper for the coming year.

A Tickle File

When running classes, doing software development and research, and writing papers, there are a number of things that must be remembered and sequenced at their proper times. In addition, there are always other people who want a piece of one's time for some reason. All of these tasks and chores can create a complex set of sometimes independent, sometimes interlocking, and sometimes conflicting demands upon one's memory and time.

One strategy for keeping track of things that need to be done involves keeping a list. However, making and

	1	2	6
1			
2			
3			
4			Combined Rating
5	1	Paper--SCiP--Sprdshet as prof prod tool (15 Jul)	110
6	2	Cognitive factors in performance testing (Lambertson)	100
7	3	Hypertext workshop? (Yes)	100
8	4	Paper--J. Clinical Monitoring--revise and return	100
9	5	Visit to NPL?	100
10	6	Courseware workshop proposal	90
11	7	Guide study--graphics enhance memory for location?	90
12	8	Library--Kosslyn article, J. Am Stat Assn	90
13	9	Paper--CHI '88--Eval in Indust Setting (Joint Expt.)	90
14	10	Paper--Eval meas in iterative design-change over time	90
15	11	Proposal--ACS, Comp Impact, what function	90

Figure 2. Tickle file.

rewriting lists can be both time-consuming and frustrating. In fact, there may be times when it seems as if one is forever recopying lists. The use of note cards may not be much better as a strategy for keeping track of tasks, since the notes may be unorganized or easily misplaced. Failing to get a task completed on time because one did not find the reminder until too late can be very frustrating. It can also be frustrating to write down a good idea and then not be able to remember where the card or piece of paper has been filed.

Using a spreadsheet program for keeping a list can eliminate the need for recopying lists and can prevent the loss of notes. It also offers additional advantages. For example, a number of time-management consultants (e.g., Lakein, 1973) propose that tasks vary in their importance and in the urgency with which they must be completed. Furthermore, one of the biggest problems with personal and professional time management results from letting others determine the importance and urgency of one's tasks, particularly when the demands of others may be more immediate than the goals one has set for oneself. Consequently, many time-management consultants recommend both a "to do" list and the frequent reevaluation of both the importance and the urgency of the tasks on the list.

Organization of the tickle file. Combining the capabilities of a spreadsheet program with some simple principles about decision making and the use of rating scales, it is possible to develop a tickle file, which avoids the disadvantages of written lists or notes and produces an effective program for managing one's tasks and priorities. For example, Figure 2 shows a portion of a tickle file as it appeared on the screen of my Macintosh during preparation of the abstract of this paper. In this case, the first four rows and the first two columns have been frozen so that the rest of the spreadsheet can be scrolled beneath them. Starting with row 5, the formula in the cells in column 1 simply assigns a number to each of the items entered in the spreadsheet in column 2. Items in column 2 represent short, mnemonic notes about various tasks, projects, pieces of projects, or other things to be done.

The column labeled "Combined Rating" contains a priority score for each task, and the entire list has been ordered from highest to lowest priority. Each priority score is the product of a numerical rating of task importance multiplied by a numerical rating of task urgency.

The columns containing the ratings of importance and urgency are not visible, having been scrolled under the list of tasks. Each cell in the importance and urgency columns contains a number representing my subjective rating of the urgency or of the importance of each project or task. At least once a week, the tasks are sorted in alphabetical order, the window on the spreadsheet is scrolled so that the urgency ratings are visible, and then the window is resized so that only a single task and its urgency rating can be seen. After the current urgency of the first task has been rated, the window is scrolled to the next item and then the urgency of that item is rated. Typically, urgency is rated on a scale from 1 to 10, although an 11 is occasionally used to force an item to the top of the list. Once the urgency of each item on the list has been reevaluated, the window is expanded to full size and scrolled back to the combined rating column, and the new priority scores are calculated. Next, the spreadsheet program is used to sort the list of tasks in descending order according to priority scores. Recognizing that the importance of a particular task can change with changing events, it is also useful to periodically rerate the importance of each task on the list, being careful to complete all ratings on one scale before doing the ratings on the other scale.

Problems solved. The print capabilities of a spreadsheet program make it possible to carry a neatly printed, legible list of the first 30–60 tasks for review while traveling to work or during periods that would otherwise be dead time. (Those who carry lap-sized computers may not even need a printed list.) A completed item can be crossed off the list as it is done. New tasks can be added to the printed list as needed, and the spreadsheet regularly updated from the list. Each new item can be given initial importance and urgency ratings as it is entered into the spreadsheet, and the item eventually finds its own level as the entire list is regularly rerated, resorted, and then reprinted in priority order.

A good idea whose time has come bubbles to the top of the list by consistently being both important and urgent. Good ideas for which there is simply not time remain in the background with high importance but low urgency. The bad ideas eventually die (due to lack of both importance and urgency) by remaining at the bottom of the list until their continued contrast with the good ideas at the top of the list forces one to recognize their lack of worth. Similarly, periodic review of the schedule chart helps maintain a sense of perspective for the year, and a conference for which it is not possible to write a paper can be moved off the list of possibilities on the schedule chart.

Since the burden of remembering the entire list of tasks is on the computer, and since the list never has to be recompiled by hand, there is no great pressure to cut ideas

or tasks from the list simply because they have low priority. An idea that consistently has high importance ratings but low urgency ratings need not perish. Indeed, as conditions change and new opportunities emerge, the importance and/or the urgency of a task or an idea that has been hanging about the middle of the list may change rather dramatically, allowing one to rehabilitate and take advantage of an idea appropriate to new conditions. In fact, on more than one occasion, the appearance of a particular conference on my schedule chart has triggered a change in the priorities of various papers or projects on the "to do" list.

Although the activities of rating, sorting, and listing of tasks, and of scheduling and rearranging projects on the schedule chart, do not prevent procrastination, they seem to eliminate the problem of forgetting, until the last minute, that one has to do some important task. As before, some things may still get done at the last minute, but in my case it is now more often a matter of deliberate choice rather than oversight. Even though a certain amount of time is spent "puttering" with the list, the ratings, and the schedule chart, it is still time spent thinking about how my time ought to be used, that is, thinking about which tasks and projects should be undertaken and what should be their scheduling and priority.

Finally, the spreadsheet program represents an external memory file into which ideas for papers, projects, and so forth, can be dumped with the knowledge that they will not get lost from the list. Although some tasks may still not get done, or some good ideas may still remain undeveloped, these things are more likely to be due to deliberate choice rather than default or accident. In addition, the external memory file can help to reduce one's anxieties about forgetting major tasks or good ideas and decrease the time one may spend worrying about forgetting to do something.

CONCLUDING REMARKS

There is more to all of this, however, than just a few anecdotal examples of spreadsheet use in time management. These examples are also intended to illustrate something that seems to be a more general phenomenon and to suggest some interesting directions for research. Since the fall of 1982, I have spent a considerable amount of time talking with dozens of colleagues in a variety of disciplines about their uses of personal computers in their professional lives. Admittedly, the sample is biased, the interviewing techniques not standardized, and the impressions subjective, but common themes have consistently emerged. One such theme is that personal computer applications programs seem to impact professionals by increasing their productivity rather than by decreasing their work load. Furthermore, most of these colleagues are convinced that the quality of their work has improved. Finally, several of them have developed some interesting and novel uses for a variety of applications programs. Old tasks are done in new ways; new things are done.

If generalizable, the observation that personal computers enhance productivity rather than decrease work load suggests a set of interesting directions for research into the uses of computer applications programs as professional productivity tools. Based on my unsystematic observations, there should be both direct and indirect effects, with the direct effects primarily resulting from the speed with which something can be accomplished, and with the indirect effects resulting from either the additional time available or from the willingness to take on work or projects never attempted before as a result of new capabilities not previously available.

The observation that many professionals are finding novel ways to make use of existing applications programs also suggests interesting directions for research. Landauer (1987) proposed that researchers interested in human-computer interaction should be interested in the invention of novel, computer-based cognitive tools (e.g., decision tools, memory aids, etc.). There are, he suggested, important opportunities for a synergy between behavioral analysis and the powerful techniques of computer science for creating programs that help with intellectual tasks. One technique Landauer believes to be useful for identifying areas of human endeavor where cognitive tools might be of use is "failure analysis." In failure analysis the investigator systematically observes the ways in which people go wrong, make errors, or are unsatisfied by the techniques available to them. The challenge for designers "is not to just think up a new gizmo for a perceived need, but to analyze systematically exactly what people need now that they don't always get, why they can't get it, and what would help them" (p. 334).

As illustrated by the examples in this paper, one application of failure analysis is the study of the novel adaptations or extensions of functionality that people de-

velop with existing applications programs. When someone adapts an existing tool to serve a new, unintended function, that adaptation may provide a valuable insight into the kind of new productivity tool that is needed. The systematic study of such novel uses may well suggest directions for the design of new, useful cognitive tools of the kinds referred to by Landauer (1987). Particularly intriguing about the possibility of designing and developing new, computer-based cognitive tools are the things that may be learned about human cognition from studying and designing the computer-based tools that amplify it.

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