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1. Introduction

Most of the articles one sees concerning the effect of automation on white-collar work seem to fall into one of two general classes: rather uncritical pæans to increased productivity or bleak visions of the physical and mental consequences of various forms of technostress. So far, scant attention has been given to explorations of the ways in which the computer-assisted personal workstation can be expected to change the fundamental nature of white-collar work. In this note I shall look briefly at two dozen possible effects of the automation of the professional workplace. I shall consider them in pairs, partly as a rhetorical device to accentuate the contrasts, but also as a monitory device to caution the reader that the obvious desirable aspects of personal computing tend to be counterbalanced by less desirable, and often unexpected, aspects. The first of these pairs provides the *theme* of this discourse; the rest are the *variations*, either on the original theme or on earlier variations.

Throughout the note I have used two sets of terms generically: those having to do with *the professional*, including also *professional work*, and *the professional workplace*, and those having to do with *the personal computer* and *personal computing*. In the first case, I could equally well have written of *the executive*, *executive work*, and *the executive workplace*; in the second, of *the computer-driven workstation*. Had I done so, some small emphases may have needed change here and there, but the central message would have remained the same: If you work in an office environment, the integration of computing into the tools that you and your associates use will change the nature of your work in a myriad of ways. If you are to work effectively in this environment, you must become aware of these changes and how they can be expected to influence you, your co-workers, and your work relationships. Furthermore, the primary product of most office work, whether it is driven by executives or professionals, is paper. Most of what follows, then, is concerned with the rôle of the personal, computer-assisted workstation in helping the professional [executive] to generate the proposals, reports, presentations, journal articles, memoranda, and other documents that are so central to his occupation.

Theme: Art ≫ ≪ Transcription

There are two kinds of change that computers can effect in the professional workplace: They can speed the processing of work in the traditional style, and they can enable fundamentally new styles of work to emerge. One of the primary traditional office tasks is the transcription of the ideas and preliminary drafts of a professional from one medium onto another. Much of the discussion of the increased productivity of the automated office centers about the ease and speed with which these transcriptions can be accomplished with the aid of a computer. Impressive as these improvements are, they are almost certain to be less dramatic in the long run than the changes in working style that can collectively be called, for want of a better term, the *artistification of the professional*.

The artistic nature of the pure programmer has an honored place in the folklore of the sociology of computing. It is certainly supported by the nocturnal habits, eccentric behavior, and compulsively déclassé attire and coiffure of the stereotypical specimen of *homo programmaticus*, even if it is not always evident in the beauty of his work product. It has been generally assumed that computing work *attracts* such people. While that is true, it is not the whole story; there is also a sense in which it can be said that computing work *creates* such people.

The artistic urge has remained latent in many of us because we have lacked the skills necessary to express it. The personal computer is putting a treasure chest of those skills onto every professional desktop. With the *ability* to express ourselves more freely will come the desire; with the *desire* (and a little secret practice) will come the exercise of this new capability. With its exercise will come some elements of the artistic temperament.

As a result, to the surprise of many of us, the regular use of a personal computer-assisted workstation will convert the professional workforce into a quasi-artistic workforce. To some extent this will be the rather obvious result of the professionalization of certain design-oriented functions. To a larger extent, however, it will be the result of the largely *un*anticipated artistification of the hitherto routine and pedestrian aspects of professional life. It used to be, for instance, that a professional would dictate or handscrawl the text of a document in preparation, describe any artwork that was to be included, and hand the resulting bundle off to a set of artisans for conversion into a readable whole. This same professional, computer-assisted, can now do not only his own document layout, including type fonts, faces, and sizes, but also his own artwork, ranging from simple line drawings, through sophisticated graphs and charts, to bit-mapped half-tones of considerable complexity, all of which can be enhanced by automatic curve-smoothing, line straightening, shading and texturing, and other handwork-enhancing utilities.

This new breed of artistic professionals will need as much management as did their pre-artistic predecessors, but because of their burgeoning artistic temperament, they will tend to respond differently to conventional management practices and techniques. It should make for an interesting few years.

Variation 1: Freedom of Expression ≫ ≪ Consistency of Format

One characteristic of the artist is his desire to express his own individuality. In the professional workplace this will surface as an inability to leave any document alone. In the old days the difficulty of the mechanics often served as a governor on the urge to change things. Suggested emendations were generally local and limited in scope. Sweeping changes were rare. Technology has made total reorganizations of large documents quite manageable and has provided every professional with the means to play with the appearance of a document. The forms explosion that follows the introduction of the personal computer into almost any office is a wonderful example of this effect at work. Almost the first thing that the newly artistified professional does to demonstrate his new-found prowess is to create a new form, even though the old form was adequate and there are plenty of them left.

The pre-artistic professional developed the content of a document, but generally left it to his administrative and clerical staff to establish its format and appearance. One result of this arrangement was that the semiliterate phrases penned by the brilliant but grammarless professional could be turned into polished prose before being released. Another was that all documents originating from an office exhibited a common look, regardless of the personal idiosyncracies of the several professionals served. In some cases, this common look extended beyond the department to encompass the whole organization, providing a central part of the corporate culture and personality. A person receiving such a document could tell at a glance its place of origin, and, in the case of a long document, could quickly develop a pretty accurate feeling for how it would be organized.

Professionals are now free to indulge in their own whimsies as to how their letters and memos should be formatted. They can create their own letterheads and forms, even incorporating their own logos, should they so desire. They can immortalize in print their own approaches to spelling and grammar. What the individual gains in freedom of expression the organization loses in consistency of output appearance and style. For those situations in which flair, *panache*, and a touch of poetry are appropriate, the organization's loss is the world's gain; where regularity and uniformity are important, however, artistic license in the writer can generate confusion for the reader.

Variation 2: Total Control ≫ ≪ Lost Thoughts

One of the most frustrating things a writer can experience is dropped thought: He begins a sentence or paragraph knowing the point he wishes to make, only to have it fade out of existence before he has

captured it on paper. Sometimes he can recapture the mental context and the thought, sometimes not. In either case the flow of thought is disrupted and the compositional task does not go smoothly.

In the pre-computer days the professional used the pencil as his primary recording device. With all its limitations, the pencil provided a comfortable and fairly rapid means of converting thoughts to text, so that relatively little thought had to be devoted to the mechanics of the process. The artistified professional, on the other hand, has assumed total responsibility for the appearance, as well as for the content, of his document, and has access to a substantial armory of sophisticated tools that enable him to achieve the effects he desires. He now has more options than in the pencil days -- for example, he can use *italics*, **boldface**, or <u>underlining</u> for emphasis instead of only <u>underlining</u> -- but the mechanics for invoking them are necessarily more complicated. Involvement with complicated mechanics is a substantial barrier to continuity of thought.

Variation 3: Immersion ≫ ≪ Insulation

The pre-computer professional was insulated from the tedious mechanics of refining his work into publishable form. His handwritten drafts were transformed into typescript by the clerical staff. His hastily plotted graphs were carefully redrawn neatly and to scale by the drafting department. His ideas and sketches blossomed into finished artwork under the hands of the technical illustrators. His cost distributions and spreadsheets were prepared by the accounting department. When all of the pieces were satisfactorily assembled, he had only to review them for accuracy, and then send them off for photo-composition and typesetting. All of this happened out of his sight and, although quite people-intensive, appeared to him to happen quite "automatically". The people who did these things were specialists. They did their work quickly and well (if he was lucky) and did not require detailed direction from the professional. Detailed direction was possible, of course, but the system was designed to discourage it; the goal was to free the professional of these petty concerns so that he could get on with his own more exalted work. And, because more direct involvement was difficult and time-consuming, most professionals did, in fact, leave these details in the hands of the specialists.

The computer-assisted professional, however, has a rather different set of assistants. Instead of a clerical staff he has word-processing and document-preparation systems. Instead of a drafting department he has automatic charting programs that prepare bar, line, and pie charts directly from tables. Instead of technical illustrators he has picture-making systems that can take his own hand drawings, either raw or smoothed, corrected, adjusted, and refined in any of a dozen different ways, and integrate them with standard modules extracted from a library or developed from scanning other illustrations. Instead of the accounting department he has electronic spreadsheet programs to do his cost distributions and tabulations automatically. In many cases, the final product is publication-quality when it comes off the terminal,

without needing photocomposition or typesetting. The process is now truly automatic; it is done by his personal workstation instead of by people. It no longer happens out of his sight or without his direct control, however. He must learn how to shape the output of each process to the purposes he has in mind (including input into the next process) and how to fit the collected results into a coherent whole. He must become directly involved in all of the steps of the process.

It's not really true that he *must* become so involved, of course. He could provide the specialists with access to his files and operate very much as before, but he will *choose* not to do this. A modern hands-on personal computing system with a reasonable subset of the features mentioned above exerts an attraction as seductive as the Lorelei. It is very rewarding to watch one's own creation take shape under one's own hands. The computer assist allows the professional to try, on his own, things he might have been reluctant, in public or through other people, to try in the pre-computer days. He will make more modifications; he will change and change back. He will in general be much more adventuresome than he would have been, for he no longer has to worry about the length of the specialists' queues, or about the risk of appearing indecisive, or about the irritation that often accompanies the redoing of an apparently finished product. The fascination of direct control accompanied by immediate feedback is immense, and it generates a desire to continue the cycle: The immediate feedback of the system seems to demand immediate feedback from the operating professional. The result is total immersion for long periods of time.

Variation 4: Play ≫ ≪ Work

The play aspect of the personal computer is closely related to the total immersion just described, for immersion tends to accompany enjoyment. One source of enjoyment is the sense of fulfillment that accompanies use of a computer-assisted workstation. This is to some extent a result of new-found competence, and perhaps it will disappear in time. For at least the next several years, however, the introduction of new products and new capabilities will preserve the playful nature of personal computing. It needs to be emphasized that play is not necessarily bad; well-designed play can be enormously instructive. It is likely, however, that professional play on the personal computer will take much the same form as did programmer play on the first couple of generations of mainframe computers. That is, there will be much limit testing and experimentation with the undocumented aspects of the systems available.

Play that incorporates learning is not counterproductive, but not all computer play is so benign: Non-productive play *does* interfere with work. One side effect of the total immersion syndrome is the possibility that use of the personal system can become so rewarding that it becomes an end in itself,

instead of a means to accomplish more constructive ends. As long as the system is fun to use, excuses will be found to use it as much as possible, even where such use is inappropriate.

Variation 5: Instant Response ≫ ≪ Lack of Reflection

One of the joys of computer-assisted professional work is in the instant response of the system to the commands of the artist. No sooner does he think of a thing than it takes shape before his eyes. It is becoming increasingly common to carry a document through from conception to final hardcopy form in a single session. While this mode of operation allows some astonishing bursts of productivity, it also provides scant opportunity for reflection.

Not all minds work alike, but many of us find that much of our productive work is done off-line: When we have wrestled with a problem awhile, put it aside for awhile, and then come back to it we often find that our subconscious was working on it during the interim and has discovered a way around a seemingly insuperable barrier, or through a seemingly impenetrable maze. This same mechanism operates when any thought process is pushed into the background to make room for more immediate concerns. Thus it is not unusual for the subconscious to take advantage of whatever dead time occurs between the successive steps of a traditionally organized project to suggest a modified approach that is preferable to the one we originally had in mind. In providing a computer assist that allows a professional to move from concept to camera-ready copy in one sitting we are also depriving his subconscious of a chance to work on the task.

Variation 6: Avoidance of Translation ≫ ≪ Incidental Independent Review

It has been observed several times above that the computer assist allows a professional to take a document from concept to camera-ready copy without the intermediation of specialists. One obvious benefit of this procedure is a reduction in the number of translating filters through which the product must pass. The result will be much closer to the original concept than was formerly the case, and will be achieved with much less of the frustration attendant upon miscommunication.

A less obvious, and less beneficial, result of this procedure is the elimination of the several independent reviews that occurred as each piece of the product passed through its specialists' hands. To begin with, the originating professional found it necessary to express his intent clearly in order to ensure understanding on the part of the specialists. Then, the specialists tended to read his work more carefully, for the material was unfamiliar, and they did not have the author's advantage of knowing his ultimate purpose; they had to make do with what he had written. As a result, they did not make allowances for the author's unexpressed intentions. By contrast, it is extremely difficult for an author to proofread his own work

competently, especially when he has been the typist as well. Traditional processing resulted in a document with fewer errors than is usual in a one-person process.

Variation 7: Faster Results ≫ ≪ More Errors

The usual productivity claim for a computer-assisted system is that one can produce more in less time. The rub comes when one asks "Produce more *what*?" One answer to the question -- more errors -- is implied by the loss of independent review noted in Variation 6. Another -- similar -- answer is to be found in Parkinson's Law as applied to paperwork systems. Parkinson's fundamental law is that work expands so as to fill the time available for its completion. When applied to paperwork systems it becomes *Reporting requirements expand until the most competent system in the field can no longer keep up with them.* In other words, as soon as the computer-assisted professional is capable of generating n pages a year, the reporting system will demand $1.5n$. The result is that the professional is always behind, and so is always eager to shorten the time from concept to product. He continues to expand his use of his personal system in order to avoid the necessity to use the specialists.

Variation 8: Professional as Author ≫ ≪ Professional as Secretary

The advantages of a computer assist for individual authorship have been amply described. There are significant additional advantages for multiple authorship. Not only does each author enjoy the individual advantages, but the team is enhanced by the ease with which text can be shared, multiply edited, combined, and moved, whether the several authors are co-located or separated by the width of a continent or an ocean. These amenities make it much easier to achieve an effective division of labor, a consistent style, and a smoother blend. On the other hand, this happens only on the authors' personal systems; a necessary consequence is that the professional becomes his own secretary. This is not necessarily bad, but whatever time the professional spends at secretarial work he does not spend at professional work. Furthermore, the secretarial work in question is done more slowly than would be the case if it were done by a secretary, and it is done at professional, rather than at secretarial, wages.

Variation 9: Appearance of Product ≫ ≪ Content of Product

Very little of the discussion of productivity one sees in the trade journals is concerned with what is probably the greatest advance provided by the computer-assisted workstation: the *appearance* of the product. In the pre-computer days, preliminary copies of documents-in-progress were generally rather ratty looking. This was the result not only of the fixed-pitch machines on which they were composed, but also of less-than-adequate resolution, thermal fade, mimeo smudge, and other artifacts of the pre-computer office. Today, however, the personal workstation can have an individual hardcopy device of essentially arbitrary quality, capable of printing anything his VDT can show. One suspects that the brave

show made by these printers is responsible for much of the hyperbole surrounding computer-assisted workstations: It is not so much that more work is being done, or that it is being done better, but that it *looks* better, regardless of what it contains.

Variation 10: Programs that Spell ≫ ≪ People Who Spell

The decline in reading that has accompanied the growth of television has, as a side effect, contributed to the atrophy of spelling skills, at least in the United States. An inability to spell a large portion of his technical vocabulary is a common failing of the young professional. It is compounded by grave deficiencies in grammar and a general inability to write coherently, much less cogently. There are two fundamental approaches to a problem of this nature: Teach the professionals the necessary skills, or eliminate the need for them. It is the second of these that receives the most emphasis in the computing community. There are spelling programs, hyphenation programs, stylistic analysis programs, even some grammatic analysis programs. The result, at least for the English language, is rather predictable. Somewhere between 80% and 90% of the problem is relatively trivial,* but the balance is extremely difficult. Spelling programs, for instance, can find the more creative spelling errors because they result in imaginary words (such as *thier*), but they have trouble detecting some of the most common errors (such as misuse of *it's* and confusion between *there* and *their*) because the offending word in each case is a real one. As programs of this sort become more able, more of the proofreading burden will be shifted to them, and people will become less willing to do careful and competent proofreading. (They may also become less able to do so, for it is possible that the errors made by programs are so different from those made by people that they are more difficult to detect.) The result may well be a serious decline in the overall quality of the finished product.

Variation 11 (Coda): Friendly Systems ≫ ≪ Friendly People

As his personal system becomes more friendly, the professional is going to be willing to spend more time with it. On the purely physical side, until quite recently it was impossible to spend a full day at a workstation VDT because of poor resolution and jitter: Staring into a screen possessed of such defects quickly produces eyestrain, headaches, and, in extreme cases, disorientation. Friendly terminals have rock-solid displays, extremely high resolution, non-fatiguing contrast, clear, precise graphics, etc. Friendly systems eliminate frustration as effectively as friendly terminals eliminate fatigue. As the

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* But the trivially correct approach is often not taken. There are hyphenation programs that work from rules rather than from tables, despite the fact that there are no reliable rules for hyphenation in English.

barriers to extended use fall, the attractions for the personal systems will become more strongly felt, and the professional will spend more time communing with the system instead of communicating with other people. Naisbitt (in *Megatrends*) has postulated that the prevalence of "high tech", in the workplace and elsewhere, will lead to "high touch". Perhaps. The domination of high tech is just around the corner; let us hope that Naisbitt's vision is correct.

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