Masculinity and the Machine Man: Gender in the History of Data Processing

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Historian David Noble has characterized science as "A World Without Women," arguing that this is a result of the patterning of universities on a medieval monastic model.[1] While this phrase may describe academic computer science it was never true of data processing, as the administrative use of computers and punched card machines was known until the 1980s. Corporate computing departments were full of women from the very beginning, but men and women were clustered in different occupations. My aim here is to explain why this occurred and how this sexual segregation has evolved over time.

I chart the role of gender in the history of data processing from the 1950s to the 1970s, with an epilogue exploring census data evidence to the present day. The chapter begins with a look at the gendering of work in the punched card installations and the influence this exerted on early administrative computing work. It explores the status of women as data entry workers and looks at the relationship between this form of feminized labor and the emerging professionalization agenda of data processing supervisors. Efforts by the Data Processing Management Association, a group for data processing managers and supervisors, to upgrade the standing of its members reflected aspirations toward a particular vision of masculinity, called here the masculinity of the organization man, and an equally important desire to separate the new field from the feminized world of office work. In this case the push to position business computing as men's work occurred because of, not despite of, the presence of women in the field. The conclusion sketches the relevance of this historical perspective for investigation of the present day role of gender in computing.

The Sex Typing of Data Processing Work

In 1954 General Electric's appliance plant in Louisville, Kentucky became the first site in America to use an electronic computer for a regularly scheduled administrative task. Within five years it had been joined by thousands of other companies, in a sudden wave of computerization. Computers seemed revolutionary, and computer departments received generous budgets, modern facilities and nice furniture. Within a few years administrative applications such as payroll processing, billing, and accounting had replaced scientific and technical computation as the dominant tasks for which organizations ordered computers and staffed computing installations.

But when firms first computerized they frequently carried over the personnel and culture of the existing tabulating machine department into their new "electronic data processing" department.[2] During the 1950s punched card data processing and administrative computing were inseparable, and both were growing rapidly. The computer industry grew out of the earlier office machine industry, and in particular from the two suppliers of electro-mechanical punched card machines: IBM and Remington Rand.[3] Likewise work practices and occupational identities in data processing evolved from those already established for administrative work rather than being transplanted from the laboratory. Punched card work was renamed "data processing" to emphasize its close relationship with electronic data processing. Companies used their computers to do the same kind of tasks, in the same kind of way, as their punched card machines.[4] The most common applications for each were payroll, accounting, billing, and inventory control.

To understand the gendered identities of corporate computing we must therefore begin with those of punched card work. A typical punched card operation employed roughly equal numbers of men and women. But the women were mostly to be found sitting at key punch machines, using a keyboard to code data from paper onto punched cards. When people spoke of "punched card machine operators" they meant people controlling other machines that processed data

already punched onto cards. This work involved a great deal of hands on configuration and operation of specialized machines such as sorters, collators, multipliers, and tabulators. The machines were not programmable, so to run a single job machine staff had to repeatedly feed decks of cards through different machines in an elaborate sequence of operations. Machine operators were usually men with a high school education, who learned their craft on the job beginning with simple routine tasks and gradually progressing to complex work such as control board writing and the development of new procedures (which were not always documented in writing).[5] Little formal training was available in this field. Many were hired as clerical workers before shifting to the machine room, and aptitude tests were sometimes used to identify potential operators.[6] The career path led upward to supervisory positions and eventually to department head.

The tabulating room was a noisy, stuffy place often consigned to a basement or other out of the way location. Punched card departments hosted a masculine craft culture side by side with feminine clerical work. One veteran of a Bureau of Public Debt tabulating center in Chicago recalled that "When the weather got too hot (and after the women secretaries, control clerks left), we men would strip down to our shorts." [7]

In 1958 a doctoral student gathered data from most (forty two) of the punched card installations operating in Oklahoma City, then one of the fifty largest cities in America. Melvin Edwards documented a consistent trend from women to men as one ascends the ladder of pay and prestige within data processing. At the bottom, punch workers accounted for around thirty seven percent of the workforce in the punched card installations. They were all women. Twenty four percent of the punched card machine operators were women, and ten percent of the supervisors. Key punch work was a dead end job. Although the average key punch operator had more experience in punched card work than the average machine operator she could hold little hope of advancement with the department. Only three per cent of the punched card machine operators had originally been hired as key punch operators.[8] No department supervisor had worked as a key punch operator.

 Edwards concluded that

> The job classifications in numerous machine-accounting units at first appear to provide a natural promotional sequence from clerk to key-punch operator and finally to supervisor. However, the statements of machine supervisors indicated that in most instances promotions occur only within job classifications rather than from one classification to another. The basic reason for this is the preference for men in machine operator positions, and women in key-punch operator positions.

This preference is an example of what labor historians call "occupational sex typing." One of the most relevant insights from the body of work on labor and gender is that the gender segregation of different kinds of work has usually been presented as based on the natural aptitudes of men and women. But closer analysis reveals that definitions of these aptitudes shift and that a particular activity can be described in different ways to emphasize characteristics associated with either sex.[9]

In the 1950s sex discrimination was legal and commonplace. Job descriptions specified sex and age requirements for many positions, and newspapers grouped their classified ads into separate areas for men and women. Some occupations, such as key punch operation or auto mechanic, were very rigidly sex typed. Others were mixed but skewed to one sex or another. Punched card

machine operation fell into this category. This did not necessarily reflect a mix within most individual workplaces. The gender allocation of particular jobs might vary from one firm to another, or reflect the desirability of particular jobs. For example waiters and waitresses were both common, but one found men serving wine within fine dining establishments and women refilling coffee in diners.

Whether a specific company would hire women to operate punched card equipment, computers, or peripherals might have depended on its corporate culture, human resources policies, the preferences of the department supervisor, and its size. Punched card installations varied greatly in size. By 1951 Prudential Insurance had thirteen separate punched card centers, which between them employed six hundred people and more than a thousand machines.[10] In contrast, the detailed survey of the punched card installations of Oklahoma City found that the median staff size was just seven people.[11] In very small departments key punch operators might have found it easier to gain experience operating other equipment such as sorters or tabulators. When the Terre Haute Brewing Company established its punched card center it employed a male supervisor, one female assistant to help operate its handful of machines, and a number of key punch women.[12]

The most successful computer models of the 1950s and early 1960s (IBM's 650 and 1401 machines) were sold as complements to, and extensions of, its existing lines of punched card machines. Staff for administrative computing installations came from two main sources: existing punched card machine installations within the company and mid-level staff from the departments being computerized. As *Computing News* advised its readers in 1957: "As a rule, your good tab operators will make good [Electronic Data Processing Machine] operators…. Your operators know their present jobs -- a paycheck is still a paycheck, even when processed by EDPM. Through experience, they know the pitfalls and exceptions."[13]

In larger companies, planning for new administrative procedures and the design of new punched card applications was carried out by specialists in "systems and procedures" work, a field that boomed after World War II. These specialists called themselves the Systems Men, which gives you a fair idea of their gender composition.[14] With computerization the systems men spent more and more of their time working on the design of data processing applications, and their groups were often merged into data processing departments. Their work on computer applications was called systems analysis, a term still used today.

The one big change with computerization was the addition of a new job: programming. The packaged application software business only started to develop during the 1970s, so almost all applications were written within user companies (sometimes with assistance from consulting firms or using sample code from manufacturers as a base). Programming was constructed very differently in data processing from its conception in early scientific computing as a kind of routine mathematical labor. It was seen instead as a hybrid of aspects of the work previously carried out by operators and by systems analysts. Whereas instructions created by the analyst were previously interpreted directly by punched card machine operators, they now had to be translated into the enormously pedantic language of the computer before they could be given to computer operators. The programmer's perceived job was to take detailed flow-charts created by the analyst and turn them into program code. So in the transition from punched card work some skill and control was transferred from the operator to the programmer.[15]

The trade magazine *Business Automation* published a regular survey of data processing salaries and employment patterns. Its 1960 survey covered almost five hundred companies, and revealed

that "the computer department is still a man's world… Only two firms reported a female manager, and only one company reported a woman as supervisor of the programming section. Less than 15 percent of the programmers reported were women."[16] This should not be a surprise. Punched card machine operators were mostly men. Systems analysts were overwhelmingly male. Administrative programming was constructed as an intermediate occupation between these two existing kinds of work. It inherited the existing gendered division of work.

Data Processing: Between Office Work and Management

Edwards attributed this sex typing of data processing jobs to the "preferences" of machine supervisors. Supervisors did not work in isolation from broader cultural ideas and social trends. But with discretion to hire, fire, and promote within their departments they played a vital role in reproducing the work culture of data processing.

So why were the (predominantly male) data processing supervisors so keen to keep women corralled in the key punching side of the department? I argue that the intersection of two powerful social mechanisms, sex typing and status anxiety, gave ambitious data processing supervisors making the transition into the computer age a powerful motivation to ensure that women remained in their place. In *Beyond the Typewriter* Sharon Strom has written persuasively about the gender dimensions of professionalization efforts in the accounting field. Strom shows that much of the impetus for accountants to create legal barriers to entry and demarcate an exclusive area of professional knowledge came from an influx of women into the bookkeeping field.[17] There is no inherent point of separation between the work of the accountant and the work of the bookkeeper. But constructing an impermeable professional barrier protected the authority and earnings of male accountants.

A similar process was at work in data processing in the 1950s. Punched card machine operation was still men's work in most companies. But it was a tiny island of male craft work in a sea of low status female office labor. Operation of other administrative machinery such as typewriters, bookkeeping machines, dictating machines, addressing machines, copiers, and of course key punches was already women's work. Beginning with new occupations, such as typist, one clerical job category after another had flipped from male to female. Historians have a rich literature on this topic from the 1870s, when clerical work was an overwhelmingly male activity seen as a good starting point for the apprentice business man, to the 1920s when most clerical jobs were low-paid dead-end positions filled with women. These jobs had no prospect for advancement beyond the supervision of other clerical workers, and were seen as work a woman would do for a few years before marriage. Pay differentials, policies such as the firing of women upon marriage, and the explicit statement of gender requirements for open positions maintained a strict segregation of gendered occupations. [18]

The realities of the clerical labor market put pressure on punched card supervisors to maintain a firm gender divide between key punch operation and other kinds of punched card work and to stress the masculine nature of their craft. If a rigid separation from key punching was not preserved then the masculine identity of punched card work could suffer a precipitous collapse.

Data processing supervisors were not content merely to defend the status quo. The arrival of the computer and the ever increasing importance of data processing promised ambitious men the chance to elevate their positions within the corporate hierarchy. They associated this with the embrace of a new, and more managerial, form of masculinity. One of their main vehicles for collective mobility was the National Machine Accountants Association, founded in 1951. It was

intended for the supervisors of punched card machine departments. As one can see from the picture below its founders were entirely or almost entirely male (a woman is glimpsed in the back row).

The punched card installation supervisors of the National Machine Accounting Association gather at its 1951 Annual Meeting. From CBI DPMA collection.

The association grew rapidly, reaching the 10,000 member mark by 1957. During the late-1950s it became the main association for senior staff within administrative computing installations, leading to a name change in 1963 to the Data Processing Management Association.[19] Until the 1970s it was by far the largest computing association. [20]

In 1958 the association invited James P. Moore, the Vice President and Comptroller of the Mutual Life Benefit Insurance Company, to address its meeting. He challenged their aspirations to class mobility, reminding those he termed the "Machine Men" that "in the recent past such men were regarded by management in very much the same way as management regarded factory workers or automobile mechanics. In other words, they have been thought of in large part, and to the extent they may have been given any thought at all, as blue collar workers, or at the very least as having blue piping on their white collars." He conceded that thanks to the "electronic boom" they "seem to have a new hairdo, and some mighty attractive clothes which virtually obliterate any of the blue hues" but suggested that to succeed in "up-grading their own status and

realizing their own aspirations to management" they would have to "divest themselves extensively of the aura of technical mystery with which they like to surround themselves." [21]

The problem was not that the "machine men" were not masculine enough. The problem was that they were identified with the wrong kind of masculinity. Historians have found it useful to distinguish between the biological sexes of male and female and particular cultural identities of masculinity and femininity. These identities are socially constructed and change over time, interacting with other aspects of identity such as class and race. With respect to gender and work, the best starting point remains the seminal anthology *Work Engendered* edited by Ava Baron.[22] As Roger Horowitz has written, the book showed "how gender was embedded in daily work practices and class relations…. Baron firmly established among social historians that gender was about men as well as women."[23]

We see in Moore's dismissive comments a distinction between two different kinds of masculine identity, fissured along class lines. Moore acknowledges the masculinity of his audience but brands them mere machine men, blue collar tinkerers in love with machinery as an end in itself. He claims for management a different kind of masculinity. Following the title of William H. Whyte's hugely popular book, published just two years earlier, this might be termed the masculinity of the Organization Man. As Whyte wrote, the organization man is proud and ambitious but thoroughly vested in the culture of the organization, a contradiction resolved only by using "the language of individualism to describe the collective."[24]

This new kind of masculinity evolved along with big business. The rise of big business and corporate capitalism from the 1880s onward created many new kinds of job, but none of them fitted well with traditional masculinity. Historians have documented a number of different varieties of masculine identity in the late nineteenth century, including the rough working class masculinity of unskilled workers, the refined working-class mobility of the upwardly mobile skilled worker, the capitalist masculinity of the successful businessman, and the genteel masculinity of the traditional middle-class. Beyond the assumed possession of a penis, the most obvious uniting factor here is the crucial importance of autonomy to masculine identity. But the career's manager's power came not from owning a business but from a particular position on an organization chart. He exerted power over those below him, but only when acting in the name of those above.

In *Company Men*, Clark Davis gives an elegant explanation of the gender identity shifts necessary to legitimate corporate white collar work as manly and the resulting problem of masculine status anxiety.

> Business men attempted to demonstrate white-collar work's masculine nature by careful (sic.) excluding women from most middle- and upper-level positions…. While Americans came to view management as distinctly masculine, most firms recruited all new hires into lower-level positions. Companies thus had to convince these young men that entry-level posts offered manly opportunities. The very fact that some women held these jobs, however, called into question the acceptability of such work for men…. Seeking to combat such gender-related anxieties, companies physically separated men and women and often retitled positions based on the holders' sex.[25]

Davis adds that companies

> constructed within their corporate cultures a distinct new vision of white-collar manhood…. The corporation provided a ladder, they argued. There were high rungs and low rungs, but they were all part of the same ascension toward a noble, manly identity. [26]

The struggle of ambitious men to rise up the organizational pyramid becomes a matter not just of seeking money or power but of affirming one's masculine worth. Likewise as data processing supervisors struggled to elevate the position of their occupation, they associated this with an affirmation of its masculine character.

The interest of data processing supervisors in upward mobility required them to distinguish the putatively managerial, high-level aspects of the department's work from its less exalted technical and clerical activities. Lester E. Hill, the Chief of Tabulating for Ryan Aeronautical and one of the leaders of the national association was not afraid of hyperbole. "The machine accountant in the punched card field," he told its members in 1957, "is a combination of an industrial management engineer, an industrial accountant, and industrial engineer, general accountant, cost accountant, office manager, and executive administrator, as well as being a first rate technician. Believe me, this is some man!"[27] All of the diverse occupational identities to which Hill appealed were strongly masculine.

Punched card departments and early electronic data processing departments tended to languish under the purview of a corporation's financial staff, with the departmental manager buried in the organization chart three or four levels below the corporate controller. The men above a data processing supervisor were usually accountants, and so the immediate challenge facing members of the association in their quest to win more respect and higher status was to convince corporate accountants that they deserved more autonomy. In the early 1960s this effort produced the ill-fated Certificate in Data Processing, intended as a professional certification for data processing supervisors to prove command of a body of knowledge including management, computer technology and punched card techniques.[28] It was explicitly inspired by the CPA.

Article after article in the association's journals and newsletters hammered home the message that data processing supervisors must become more professional and managerially-oriented if they were to deserve advancement.[29] The tension between the tinkering, craft-based masculinity of the computer room and the bottom-line focus of the organization man is a recurring theme in the history of business computer use. From the punched card era to the present day the same message has endlessly been repeated: the day of the technical specialist is over and to thrive in administrative computing in the future you will need to adopt the viewpoint and culture of management rather than indulging a passion for playing with the latest technologies.[30] The advice, given by experts, trade journalists, columnists, association speakers and consultants has always seemed reasonable, and administrative computing has always granted greater pay and prestige as one moves away from programming or machine operation and into systems analysis or management. Indeed the imminent replacement of the rank-and-file corporate applications programmer by some new technique or other was confidently predicted from the 1950s to the 1990s.[31] Yet no such abrupt shift in the orientation of administrative computing staff or the balance of employment away from technical positions ever took place. To this day, the cultural gulf between IT staff and normal corporate people remains a subject of constant anguish in the business computing trade press.

The Gender Politics of Data Processing

A 1953 membership roster from the Kansas City chapter suggests that around ten percent of its early members were female, including its Publicity and Publications officer.[32] This is in keeping with Edwards' findings on the gender breakdown of punched card supervisors. The shift to computing technology may have been accompanied by a further shift toward men. A 1964 national survey found that 73 percent of its members identified themselves with the job category "Manager, supervisor, or director of data processing" and just two percent were female.[33]

The first few issues of The Hopper, the newsletter of the National Machine Accountants Association, contained studio publicity photographs of minor Hollywood starlets scattered to fill blank space throughout the publication as a kind of pin-up. But there were women present at the association's functions, just as there were women in the data processing department. In accordance with the quest of its members to ape managerial culture the association's wives were enlisted to entertain and display social graces. The main activity entrusted to women within the NMAA/DPMA was the organization of the "Ladies Program" for its annual meeting. According to executive committee minutes from December 7, 1957, plans "include a Hospitality Room with a local girl in attendance to advise the women on the things to see in Atlantic City… [O]n Wednesday there will be a luncheon and fashion show and Thursday will include a brunch and an interior decorating talk at the 500 Club." A session entitled "Women and Automation" was also promised. The ladies program was still running strong for the 1966 meeting in Chicago, where three and a half days of busy programming included a visit to the Sara Lee bakeries, a "lecture on gourmet dining and living," and an excursion to the Arlington Race Track.

The need of ambitious data processing managers to distance themselves from the feminized world of office work is seen most clearly in depictions of key punch women. Key punch workers were most definitely not welcome as members of the National Machine Accountants Association. The first issue of "The Hopper," published in 1950, included a questions and answers section. This defined "Machine Accountants" as "those men who are directly connected with the operation and supervision of punched card accounting machines in a supervisory capacity." It did not even both to pose the question of membership for key punch operators. The question "Are tabulating machine operators eligible for membership" met with the reply "The association has restricted membership to applicants in the supervisory capacity. It was thought that this would enable the Association to have a better selection of men who are experienced in tabulating methods and procedures and who have closer contact with top management."[34] In later years the association's leaders were unsure as to whether the supervisors of key punch workers should be eligible for membership. As with other kinds of first line clerical management jobs, the position of key punch supervisor was often filled by women who had advanced from clerical positions. In 1962 one spoke of the need to "upgrade the Association… and get a better caliber of person interested. I think we could well lose some key punch supervisors and pick up systems analysts …" [35] This "upgrade" would also have displaced many of the association's already small band of female members.

The presence of key punch women in data processing departments lowered the status of the field in the eyes of academic computer specialists already leery of the world of business. Walter M. Carlson, later chair of the Association for Computing Machinery, recalls the reaction from members of the ACM Council when in 1960 he presented a proposal that the association create a system of interest groups. "Insofar as business data processing was concerned, many of the ACM leaders I talked to spoke of 'super bookkeepers,' and some of them even reflected on joint

Chapter meetings with punched-card people, where the managers usually brought along their best looking keypunch operator."[36]
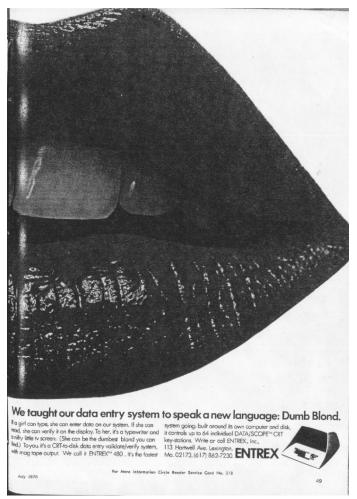
The data processing trade literature served to codify and reinforce these gender divisions. Publications such as *Business Automation* and *Office Executive* were full of well illustrated reports on data processing work within particular companies and advertisements for data processing products. Office machines such as copying machines, filing systems, and dictating machines were usually shown with attractive young women in fashionable clothes.[37] Women were also pictured next to printers, data entry devices, and tape reels in advertisements for products of a basically clerical nature. On the other hand when computers were advertised or exemplary computer installations were profiled they were usually accompanied by pictures of white men in dark suits. Occasionally these depictions were explicitly sexualized. Far more often they passed without explicit reference to the gender of the subjects. This kind of endless symbolic repetition naturalized the gendered segregation of the data processing workplace, reflecting and reinforcing the taken-for-granted associations of certain jobs and machines with men and other jobs and machines with women.

Advertisement for Source Register Punch by Standard Register,
from Data Processing Magazine, September 1966, v8n1. Image use courtesy of Standard
Register.

Association with key punch work remained a threat to masculinity into the 1960s and beyond. Standard Register, a venerable supplier of office forms and related equipment, had come up with a new kind of punch that produced both a paper form and a punched card for electronic processing. This was a small step in the direction of today's world, where users key or capture data directly rather than passing paper copies to key punch women. But as key punch operation was a low status, feminized job one can imagine user resistance to the idea. So Standard Register tried to use humor to defuse the threat to masculinity, showing that proximity to the punch had not rendered this collection of smoking, tattooed, overweight, and unsmiling blue-collar workers any less cartoonishly manly. The new system was "not for sissies…. With this machine any red-blooded guy can simultaneously punch and print…" The machine, it concluded, would "fit in just like one of the boys." This depiction of blue collar masculinity was very rare in the data processing press, prompted only here by its diametric contrast with feminized clerical work.

This routine denigration of women resulted in some advertisements shocking to modern sensibilities. Terminal firm Entrex ran a series of advertisements announcing, beneath an enormous image of plump red lips parted for a kiss, that "We taught our data entry system to speak a new language: Dumb Blond." They continued "To her it's a typewriter and a nifty little tv screen. (She can be the dumbest blond you can find.) To you it's a CRT-to-disk data entry validate verify system…" [38]

Advertisement for Entrex terminals, Business Automation, July 1970, page 49.

Perceived ties to key punch work sometimes delegitimized women from administrative programming work, turning the woman programmer into a freakish figure of fun. A humorous 1962 article, "How to Hire a Programmer," presented the misadventures of the fictional Ball-of-Wax Manufacturing Company as it launched on a comically ill-considered automation drive. Three job candidates represent the era's archetypal inept programmers. One is an arrogant, inexperienced male student in need of "a haircut and a bath." Another has terrible academic qualifications but invents experience. The final candidate

> …is female—Miss Sallyann Bunch from East Passerk, New Jersey. Sallyann has had a lot of computer-related experience: two years in the key punch pool of the Unforgivable Assurance Association of North America, Newark, and seven months in charge of tab board wire storage…

> Sallyann wears flat shoes, and she is a little cross-eyed. Her figure resembles a full potato sack. Her dress and makeup indicate that she is a solid, plain-thinking person with no frills at all. Miss Bunch is the spitting (she chews Copenhagen) image of a lady programmer.

> An offer is made to Sallyann, and she goes home to ask her mother about it.[39]

Even those who favored expanding the opportunities available to women continued to work within the framework of sex typing and its appeals to the inherent characteristics of men and women. A 1963 Datamation article used beliefs about the gendered nature of abilities and personality to argue for the desirability of hiring women, noting that "a few" companies favored women having found them "less aggressive and more content to remain in one position. Many women chose not to advance in position... others feel that promotion is a threat to their femininity." As a result "there is a considerably lower turnover rate in women programmers." She also noted that "women have greater patience than men and are better at details….it is also felt that women have a humanizing influence, making working conditions more pleasant."[40]

Not until around 1970 does any explicit discussion of sexism or the need to examine and redefine gender assumptions appear in the data processing literature. Within the Data Processing Management Association the shift was dramatic. In 1969 it awarded its very first "Computer Sciences Man of the Year" award to Grace Hopper.[41] In 1971 its magazine ran a positive feature on "Women in EDP Management."[42] A smattering of women even served in elected offices within the national association during the 1970s.

Some within the field were actively hostile to what was then called "women's liberation." Arnold E. Keller, longtime publisher of Business Automation repeatedly criticized it in his editorials and in the features his magazine ran. The emergence of this as an explicit debate does not necessarily indicate any fundamental shift in the experiences of the data processing workforce, but it does indicate a shift in the prevalent rhetoric toward regretting the low participation of women in the field's higher status jobs. More research is necessary to determine the extent to which the women's movement of the 1970s can explain the significant increase in women's work as data processing programmers and systems analysts over this decade.

Data Processing Labor in the 1970s

Into the 1970s the organization of work inside corporate computing departments continued to mirror that of punched card departments decades earlier. Key punch work remained the largest single occupation (almost a third of all data processing workers).[43] The shift from punched card machines to computers did little to change the position of key punch work, though it did trigger a major expansion of the occupation as the changeover to computer operations generally required a huge amount of new data entry work. Keypunch work remained part of the data processing department, often taking place in an annex to the computer room. Until the 1970s this was how almost all administrative information made its way into computer systems.
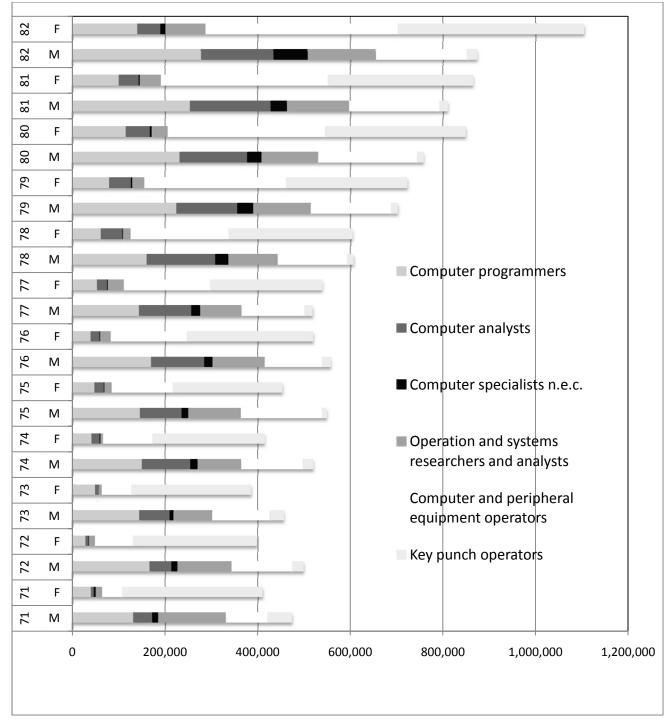
The relative pay and prestige of data processing jobs remained constant over time. In increasing order of pay and prestige they ran: key punch operator, computer/punched card machine operator, computer programmer, systems analyst, and manager/supervisor. The less well paid the job the more likely it was to be filled by a woman. Business Automation's 1971 salary survey, based on data concerning more than sixty thousand workers in 1,443 data processing

installations, found that women made up 14% of systems analysts and 21% of computer programmers.[44]

Based on her personal experience as a programmer and community college teacher, Joan Greenbaum reported that the data processing hierarchy of the mid-1970s offered diminishing opportunities for personal advancement. Data processing job distinctions, she argued, were reflected in the ethnic, gender and class positions of those recruited to fill each job:

In general, computer operators are men and the set-up and support functions are performed by women…. Applications programming titles are divided by rungs in the ladder. Today the lower rungs within the applications ladders are increasingly being filled by women; the higher one goes up the ladder, the more the positions are held by college educated males. Systems programmers, the 'elite' among programming ranks, are most often men from middle-class and professional families. Systems analysts generally are selected from the same backgrounds.[45]

The United States Census Bureau added several data processing occupations to its occupation classifications for the 1970 census. This data provides access to gender breakdowns for programmer, analyst, operations and systems research, computer operator, tabulating machine operator, and keypunch operator. Here too, as one ascends the data processing hierarchy from key punch worker (eighty-nine percent female) to computer and peripheral equipment operator (twenty-nine percent female), to programmer (twenty-three percent female) to systems analyst (fourteen percent female) the proportion of women drops and the average pay rises. Even within job classifications men earned more than women. For example male analysts earned forty-two percent more than their female colleagues.[46]

Estimates of Employment in Computing Occupations 1971-1982 from the Current Population Survey (for clarity the sparsely populated categories of tabulating machine operator is excluded). Bars are plotted left-right in same order as legends top-bottom.

From 1971 onward the same classifications were used in the monthly Current Population Survey. As this graph shows, data processing was by no means a world without women during the 1970s. Overall employment of women in these job categories was only about one sixth lower than that

of men in the early 1970s. From 1979 onward women outnumbered men. But, as before, women were doing different kinds of work.

The vast majority of female data processing workers in the early 1970s were performing data entry work. Women accounted for eighty five percent of keypunch operators in 1971, rising to ninety five percent a decade later.[47] As the decade goes on we see an influx of women into the job category "computer and peripheral equipment operators." In 1971 more than two thirds of these workers were men, little changed from tabulating work in the 1950s. By 1982 this breakdown had been reversed, with two thirds of a vastly expanded pool of operator jobs held by women.

Changes were less dramatic in the other categories. The numbers bounce around from year to year, with a trend of increasing women's representation in most jobs. Women made up twenty three percent of the programming workforce in 1971 and thirty-four percent in 1982. Thirteen percent of analysts were women in 1971, rising to twenty-four percent in 1982. Of course women's share of the overall labor force also increased during this period, by about six percent.

I suspect that the statistical flip of operations work from male to female reflects the increasing use of minicomputer and personal computer systems for administrative work. The adoption of word processing technology during the late 1970s led to the creation of many new jobs for word processing operators.[48] This presumably led to the reclassification of women who had formerly been typists or clerks as the operators of computer and peripheral equipment.

The published tabulations of the 1980 census provide consistent data (programmers thirty-one percent female, analysts twenty-two percent, operators fifty-nine percent). Only seven percent of women working as operators had completed four years of college, compared with forty-six percent of those working as programmers. Work was segregated by race as well as sex – blacks were overrepresented among keypunch operators but underrepresented among programmers and analysts. [49]

While there were some shifts in data processing labor from the 1950s to the 1970s the most striking finding is how little changed. Women were still concentrated in the lowest paid, lowest status jobs with the worst prospects for career advancement. But one key lesson from labor history is that it takes constant effort to keep things the way that they are. Stasis is every bit as much an accomplishment in need of historical explanation as is change.

After Data Processing: The 1980s and Beyond

By the 1980s "data processing" was starting to sound old fashioned. Computer departments received new names, such as information systems. The Vice President of Data Processing gave way to the Chief Information Officer. This reflected a technological transformation, in which the proliferation of personal computers, minicomputers and video terminals was decentralizing computing work, creating many new kinds of computer jobs, and allowing many more people to directly use and even create computer applications.

Changes in the computing workforce remained incremental. Space does not permit a thorough presentation of the Current Population Survey data from the 1980s to the present day, the interpretation of which demands careful analysis because of several discontinuities in the categories and coding schemes.[50] But until 1992 the total number of women reported in computer related occupations continued to exceed the number of men. As in the late-1970s women were clustered in the lowest status work categories of operator (which remained about two-thirds female) and data entry keyer.[51] About thirty-seven percent of programmers were

female from 1982 to 1992, with no clear trend up or down. Because of the rapid growth of the category this still meant a two thirds increase in the actual number of women programmers reported.

Since 1992, when a new set of occupational classifications was introduced, the overall number of women reported in computer related occupations has been fairly constant at around one and a half million, while the number of men has doubled to just under three million. This might suggest a stagnation for women's career prospects in computing. But a closer look at the data presents a different and more encouraging picture. The number of women working as data entry clerks and computer operators has dropped dramatically. This has been counter balanced by a rapid increase in the number of women classified as systems analysts and computer managers.

Women's percentage share of the job categories most closely related with programming has fluctuated over time, in part with changes in the categorization method. But stasis in percentage terms can still mean rapid growth in the employment of women. For example, a "computer analyst and scientist" classification was used in the Current Population Survey from 1992 to 2002. Women made up around twenty-nine percent of this category throughout the period. But looking at numbers, rather than percentages, shows that the number of women reported in this category almost tripled in ten years. Likewise, from 1992 to 2002 aggregate female employment within the categories of software developer and systems analyst/computer scientist increased by 83 percent.

The most recent data, from 2002 to 2006, shows no exodus of women from high status computing positions even as female computer operator and data entry jobs continue to vanish. Women's share of the computer programmer classification was around twenty-five percent in recent years (down from 35% of "computer software developers" in 1991 and 1992). But the importance of this category has been shrinking with the move to packaged software. In fact the aggregate number of women reported across the high-status categories of computer and information science manager, computer scientist/systems analyst, computer programmer, and computer software engineer rose by nine percent from 2003 to 2006.

The historical pattern of women's concentration in the least desirable computing jobs has been partially reversed. As one looks from programming to the higher status work of analyst or manager women's representation actually increases. In recent years women held around a thirty percent share of the new "computer and information science managers" job. And the job of systems analyst, held by a relatively large and growing number of women, remains higher level and better paid than that of programmer. This trend seems likely to continue -- according to the Occupational Outlook Handbook the number of programmers will decline in coming years while the number of systems analysts rises.[52]

Implications for the Women in Computing Literature

Because of the intended audience of this volume my conclusions address the implications of this historical story for the voluminous present day literature on the under representation of women in computing. Its relevance lies not just in uncovering factual nuggets but, as work in the humanities is supposed to, challenging the implicit assumptions underlying current thought. Space limitations prevent me from nuancing these suggestions or providing detailed evidence.

One challenge is conceptual. Much current discussion concerns gender problems within "the profession of computing." No such profession exists, making it a unit of analysis that obscures much more than it reveals. Consider two facts.

First, computing is not a single kind of work but a collection of hugely diverse jobs across many industries, from help desk worker to CIO and from genome database expert to hardware salesperson. The rhetoric of computing as a single profession first surfaced in the 1960s. It never became reality, but when relatively few people worked directly with computer technology was at least a coherent concept. Today a huge proportion of the US workforce spends most of its time interacting with computers, but only a small and arbitrarily chosen proportion of this activity would be considered "computing." (Estimates of the "IT worker" population from different bodies range from three to ten million, though no one seems to consider financial analysts or bloggers to be part of the IT workforce.) While IT jobs all involve computers their differences are more profound than their similarities. Each has its own gender dynamics. We see, for example, that women were always over represented in data entry work, but have now made up ground in systems analysis and computer management while losing it in programming.

Second, not one of these many IT occupations has professionalized. We saw that data processing supervisors attempted this in the 1960s, and a comparable effort is underway today in software engineering. Professional fields have various characteristics, traditionally including a professional graduate degree, legal monopoly on practice in a certain area, continuing education requirements, strong professional associations, accreditation of degree programs, and self regulation. These are conspicuous by their absence in computing. (The ACM and IEEE serve most effectively as scientific societies but represent only a tiny fraction of the IT workers in the US.) Recent years have seen an influx of women into well paid professional fields such as law and medicine. Perhaps the failure of IT occupations to professionalize is more off putting to women than men.

This perspective offered here of the gender dynamics administrative computing work as an evolution of earlier punched card labor practices gives an interesting contrast with the tendency in discussion of women and computing to begin with ENIAC and other experimental scientific electronic computers. We should follow the advice of the late Mike Mahoney to look at the "histories of computing(s)" rather than a single "history of computing."[53] Thinking of computing as a single area of activity makes it hard to understand why women were inventing programming in the 1940s but made up only a small proportion of the corporate computing workforce a decade later. This situation looks very different if we conceptualize programming as a task carried out in many different social contexts, or in Mahoney's terms in multiple computings each with its own history. Why would we expect the accountant in charge of an insurance company's project to staff its electronic data processing department in the mid 1950s to be guided by the fact that participants in the experimental military/academic ENIAC project believed female mathematicians to have an aptitude for translating mathematical methods into switch and wire configurations?

History broadens our perspectives. The literature on women in computing is dominated by discussion of computer science education. Fixing computer science is equated with fixing computing. This is justified by the metaphor of the pipeline carrying women from specialist education into IT work. Yet we saw that the gender dynamics of data processing were well formed by the 1960s, before undergraduate computer science education was an appreciable factor. Gender dynamics were shaped instead by the specific historical legacy of data processing

work and the broader gender politics of corporate society. So to understand gender segmentation in the workforce, we must study the workplace as well as the classroom. It's encouraging that women's participation in the more prestigious and better paid of the computing occupations, particularly in management and systems analysis, has not suffered anything like the catastrophic drop in absolute numbers faced within computer science degree programs.

Of course the world has changed since the 1960s. Computer science became a reasonably popular major, and many more people hold degrees. Computer science degrees are now expected in some occupations, most notably systems programming. But most IT jobs have remained open to workers with training in many fields. Computer science is only one of several IT fields, alongside management information systems and informatics. Even so, the NSF found that only one third of undergraduate degrees held by workers in "computer-related occupations" were in "computer and information science." For programmers the figure was forty-two percent, and for analysts thirty four percent.[54] Historically the use of computers in business has always been seen as a hybrid of technical and business knowledge, and today an ambitious analyst would be still be more likely to seek out a graduate degree in business than in computer science. Furthermore four year degrees remain far from universal in computing occupations. The number of computer science degrees ever granted in the US is much smaller than the number of people holding vendor-issued technical certifications such as those granted by Microsoft and Cisco. Today around two thirds of programmers hold bachelor's degrees (which still suggests that less than thirty percent hold computing degrees) but operator and help desk positions are held mostly by the high school educated. There are issues of social class at work here that deserve more attention.

To understand the experiences of women in computing we must look at gender identities, including both masculinities and femininities, and their relationships to specific occupational cultures and broader historical trends. Computing was never a world without women, and the analysis of gender in computing can never be a world without men.

[1] David F. Noble, <u>A World Without Women : The Christian Clerical Culture of Western Science</u>, 1st ed. (New York: Knopf, 1992).

[2] Thomas Haigh, "The Chromium-Plated Tabulator: Institutionalizing an Electronic Revolution, 1954-1958", <u>IEEE Annals of the History of Computing</u> 23, no. 4 (October-December 2001):75-104.

[3] The transition is explored in James Cortada, <u>Before the Computer: IBM, Burroughs and Remington Rand and the Industry they Created, 1865-1956</u> (Princeton, NJ: Princeton University Press, 1993).

[4] JoAnne Yates, <u>Structuring the Information Age</u> (Baltimore: Johns Hopkins Press, 2005).

[5] Thomas Haigh, "Technology, Information and Power: Managerial Technicians in Corporate America" (Ph.D., University of Pennsylvania, 2003), 152-173.

[6] Ernest J. McCormick and Robert H. Finn, "Tests for Use in Selecting IBM Operators", <u>Journal of Machine Accounting</u> 6, no. 2 (February 1955):12-13, 17.

[7] John J. McCaffrey, <u>From Punched Cards to Personal Computers</u>, 1989, contained in John J. McCaffrey Memoirs (CBI 47), Charles Babbage Institute, University of Minnesota, Minneapolis.

[8] Melvin Lloyd Edwards, "The Effect of Automation on Accounting Jobs" (Doctor of Education, University of Oklahoma, 1959). Quote from page 145.

[9] See, for example, Ruth Milkman, <u>Gender at Work: The Dynamics of Job Seggregation by Sex During World War II</u> (Champaign, Illinois: University of Illinois Press, 1987).

[10] F. M. Johnson, "Control of Machine Accounting Equipment", <u>Systems and Procedures Quarterly</u> 4, no. 2 (May 1953):18-22, 26.

[11] Edwards, "The Effect of Automation" .

[12] McCaffrey, <u>From Punched Cards</u>.

[13] Anonymous, "Staff Organization and their Training", <u>Computing News</u> 5, no. 95 (February 15 1957):8-11.

[14] The systems men are discussed in Thomas Haigh, "Inventing Information Systems: The Systems Men and the Computer, 1950-1968", <u>Business History Review</u> 75, no. 1 (Spring 2001):15-61 and in more detail in Haigh, "Technology, Information and Power", ch. 3.

[15] See Haigh, "Technology, Information and Power", 291-319.

[16] Anonymous, "National Survey of Computer Department Statistics", <u>Management and Business Automation</u>, June 1960, 22. Unfortunately gender breakdowns were not reported for the other job types.

[17] Sharon Strom, <u>Beyond the Typewriter: Gender, Class and the Origins of Modern American Office Work, 1900-1930</u> (Urbana, IL: University of Illinois Press, 1992).

[18] The literature on women's office labor to 1930 is voluminous. Its initial questions were set by Harry Braverman, <u>Labor and Monopoly Capital: The Degradation of Work in the Twentieth Century</u> (New York: Monthly Review Press, 1974) and articulated most programmatically in Margery W. Davies, <u>Woman's Place is at the Typewriter: Office Work and Office Workers, 1870-1930</u> (Philadelphia, PA: Temple University Press, 1982).

[19] The history of the NMAA/DPMA is summarized by a participant in Sonya Lee Anderson, "The Data Processing Management Association: A Vital Force in the Development of Data Processing Management and Professionalism" (Ph.D. Dissertation, The Claremont Graduate University, 1987). A more critical look is given in Haigh, "Technology, Information and Power", 558-734.

[20] In 1969 the DPMA had almost twenty-seven thousand members, still several thousand more than the faster-growing Association for Computing Machinery.

[21] James P. Moore, Jr., "Management Viewpoints on Men, Machines and Methods", in <u>Data Processing: 1958 Proceedings</u>, ed. Charles H. Johnson (Atlantic City, New Jersey: National Machine Accountants Association, 1958).

[22] Ava Baron, Work Engendered: Towards a New History of American Labor (Ithaca, NY: Cornell University Press, 1991).

[23] Roger Horowitz, "Introduction", in Boys and their Toys?, ed. Roger Horowitz (New York: Routledge, 2001).

[24] William Hollingsworth Whyte, The Organization Man (New York: Simon and Schuster, 1956).

[25] Clark Davis, Company Men : White-collar Life and Corporate Cultures in Los Angeles, 1892-1941, Studies in industry and society (Baltimore, Md.: Johns Hopkins University Press, 2000), 145.

[26] Ibid, 146.

[27] Lester E. Hill, "The Machine Accountant and his "Electronic" Opportunity", Journal of Machine Accounting 8, no. 1 (January 1957):12-14, 23-25, 12.

[28] The history of the DPMA's Certificate in Data Processing is given in Haigh, "Technology, Information and Power", 567-610, 663-667 & 689-706 and Anderson, "The Data Processing Management Association", ch. 5&6..

[29] See Haigh, "Technology, Information and Power", 174-188 & 239-246.

[30] This stream of rhetoric culminated in the Chief Information Officer movement of the 1980s and 1990s. See Ibid, ch. 14.

[31] Ibid, 534-543.

[32] NMAA Kansas City Chapter, Membership Roster and Program of Meetings, 1953-54 Session, 1953, contained in Data Processing Management Association Records (CBI 88), Charles Babbage Institute, University of Minnesota, Minneapolis.

[33] Data Processing Management Association, Membership Profile, April 1964, 1964, contained in Data Processing Management Association Records (CBI 88), Charles Babbage Institute, University of Minnesota, Minneapolis.

[34] Anonymous, "Questions and Answers", The Hopper 1, no. 1 (September 1950):2.

[35] National Machine Accountants Association, Executive Committee Meeting Minutes, 21 Feb -- Verbatim, 1962, contained in Data Processing Management Association Records (CBI 88), Charles Babbage Institute, University of Minnesota, Minneapolis page 59.

[36] Walter Carlson, "ACM and Special Interest Groups", Data Base 25, no. 2 1994):9-12.

[37] A similar conclusion was reached in William Aspray and Donald deB Beaver, "Marketing The Monster: Advertising Computer Technology", Annals of the History of Computing 8, no. 2 1986):127-143.

[38] Business Automation, July 1970, page 49.

[39] Jackson W. Granholm, "How to Hire a Programmer", Datamation 8, no. 8 (August 1962):31-32.

[40] Valerie Rockmael, "The Woman Programmer: A Subjective Reflection", Datamation 9, no. 1 (January 1963):41.

[41] Anonymous, "On the Scene", Journal of Data Management 8, no. 8 (August 1970):36-37.

[42] Helen M Milecki, "Women in EDP Management", Data Management 9, no. 2 (February 1971):18-23.

[43] Anonymous, "Data Processing Salaries Report-1971", Business Automation 18, no. 8 (June 1 1971):18-29.

[44] Ibid.

[45] Joan Greenbaum, In the Name of Efficiency: Management Theory and Shopfloor Practice in Data-Processing Work (Philadelphia: Temple University Press, 1979), 99.

[46] United States Census Bureau, 1970 Census of Population, Subject Reports: Occupational Characteristics (Washington, DC: US GPO, 1973), tbl 1.

[47] Miriam King, Steven Ruggles, Trent Alexander, Donna Leicach, and Matthew Sobek. Integrated Public Use Microdata Series, Current Population Survey: Version 2.0. Minneapolis, MN: Minnesota Population Center, 2004.

[48] Thomas Haigh, "Remembering the Office of the Future: The Origins of Word Processing and Office Automation", <u>IEEE Annals of the History of Computing</u> 28, no. 4 (October-December 2006):6-31.

[49] United States Census Bureau, <u>1980 Census of Population, Vol 2: Subject Reports, Occupation by Industry</u> (Washington, DC: US GPO, 1984), tbl 1&2.

[50] All figures presented here are based on data from Miriam King, Steven Ruggles, Trent Alexander, Donna Leicach, and Matthew Sobek. Integrated Public Use Microdata Series, Current Population Survey: Version 2.0. Minneapolis, MN: Minnesota Population Center, 2004.

[51] For consistency I am continuing to count data entry work as a computer related occupation, even though the shift away from mainframes means that from the 1980s on this work was increasingly moved out of computer departments.

[52] Bureau of Labor Statistics, <u>Occupational Outlook Handbook, 2008-9 Edition</u> (2008 [cited]; available from http://www.bls.gov/OCO/.

[53] Michael S Mahoney, "The Histories of Computing(s)", <u>Interdisciplinary Science Review</u> 30, no. 2 2005):119-135.

[54] Roger Moncarz, "Training for Techies: Career Preparation in Information Technology", <u>Occupational Outlook Quarterly</u>, Fall 2002.