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Data Processing in Peacetime: Institutionalizing a Feminized Machine Underclass, 1946–1955

After the removal of the marriage bar in 1946, feminist labor activists turned their full attention to the issue of equal pay in the public sector. As women's numbers in the labor force grew, so too did their association with office work and computing in both government and industry. Gaining equal pay for the hundreds of thousands of women who worked for the government would have benefits far beyond those women immediately affected. Reformers knew that getting the government to agree to equal pay in the Civil Service would publicly establish the state's moral commitment to equality, which would put pressure on industry to follow suit.

As the nation tried to return to normality under Prime Minister Clement Attlee, however, the state believed its moral obligations to lay elsewhere. Labour under Atlee embarked on a vast series of reforms that would construct the expansive social safety net known as the welfare state. As part of the program to aid recovery, Atlee also nationalized the fuel, power, and steel industries, the railways, and the Bank of England, which made up over one-fifth of Britain's economy. He presided over a grim period of economic austerity; rationing still operated through the early 1950s, and bread—which was not rationed during the war—became rationed in peacetime. Britons faced significant hardships, from lack of housing to inability to heat their homes. At the same time, the nation lost global influence day by day, with its empire continuing to contract and its power sinking in relationship to the new superpowers of the United States and the Soviet Union. India's independence in 1947 was perhaps the clearest example of Britain's diminishing international reach and the need to reorient its role in the world.

Against this background, the government turned its full attention to the recovering home front with ambitious socialist policies aimed at minimizing want. Although Atlee used his power aggressively to try to

equalize society and the economy, equal pay was not a part of Labour's plans to create a more fair and just Britain. Seen as a side issue, women's civil rights would only be addressed through reforms that preserved the status quo of gender inequality. Women now would be positioned as dependents of a paternalistic and patriarchal system of state benefits instead of as dependents on a husband's wage.[1] The government alternately argued that the state could not afford to grant equal pay and that women did not really need equal pay because of the enhancements afforded to citizens under the new social safety net.

At the same time, the period that followed the war saw a backlash toward anyone perceived as stepping outside the bounds of mainstream gender or sexuality. A crackdown on moral "laxity" began as the leniency of the war years evaporated. Police in London and other major cities began to aggressively patrol for prostitution and homosexual sex in public parks, private nightclubs, and elsewhere. Those seen as out of place or nonconforming faced increased scrutiny. Alan Turing, at work on the Manchester Mark I at the time, was perhaps the most famous figure to have been ensnared in this sudden change in standards. His experience powerfully showed the life-and-death nature state power could bring to bear on those who did not fit the normative ideals of gendered citizenship reemerging after the war.

Because the nation needed both to rebuild and to subsidize enormous, ambitious welfare state projects, efficiency became one of the highest concerns of the British state. The government's intense interest in enhanced productivity was reflected in the frenetic production of reports on productivity that it commissioned from the Department of Industrial Research. The Civil Service was also subjected to desperate cost-reduction measures. Despite price increases caused by the significant devaluation of the pound in 1949, the government froze pay for all civil servants in an effort to raise efficiency relative to outlay.[2] However, this action was not enough to make the needed difference, and the drive to reduce costs continued. Two factors came to form the basis of the government's efforts to hold down costs and enhance efficiency: women workers and automation.

When employed in high enough numbers, women's below-market-rate pay stabilized salary outlay at a lower level. At the same time, the government sought new automation solutions to try to stem the need to hire more civil servants. Used together, these tactics were to be a magic bullet for the government's rising labor costs. Institutionalizing the connection between machine work and unequal pay would become the single most

important labor strategy in the government's plans to wring maximum efficiency from its workers, but it would also produce unexpected results. The process of turning swords to plowshares in the realm of automated work involved a return to a specific kind of normality: one in which computing was still mainly electromechanical and in which meritocratic ideals ignored gender and class discrimination in the workforce. The late 1940s and early 1950s would set the stage for the "high" technocratic era to follow in the 1960s and 1970s—an era in which the government hoped that computing technology would put the country back on track as a global, imperial power.

The changes in this period provide essential background for how, much later, computer programming aggressively altered from feminized work to a firmly masculine professional endeavor. In order to understand that gendered power shift one needs to understand how feminized machine work was engineered into the technocratic state in specific and discrete ways over a decade before. This chapter provides that background by painting a portrait of the class of machine workers on whose labor these systems were built and institutionalized. Many of these women stayed in their jobs for only a short time, and even those who worked for decades remain relatively faceless due to undervaluation of their work. They appear in the archival record as a group rather than as individuals and therefore must be historically analyzed as a class. This can help reconstruct how institutional strictures combined with cultural norms to shape more than just women's career paths: The entire edifice of the technological state depended on the development of this category of labor.

Ensuring High Turnover for Women Workers

In January 1937, the Civil Service Arbitration Tribunal heard a request brought by the Civil Service Clerical Association on behalf of the all-female typing grades. Since 1929, any civil servant in the typing grades who was required to take on the work of a higher post, due to the absence or overwork of a higher civil servant, would be entitled to extra pay only after performing the job for a period of six months. The official reasoning was that such a timeline provided a "qualifying" period for the temporary post holder, but six months was also the time limit for an absent employee to take paid leave. As a result, low-level women workers often fulfilled the duties of higher civil servants without any extra salary outlay on the Treasury's part. By the time the six-month training period was over, the absentee had usually returned. This created a situation in which

women workers at the bottom of the labor pyramid perpetually took on the work of their supervisors without recognition or compensation.

The government balked at shortening the break-in period or paying stand-in employees more to do extra work, because it felt that "double payment ought not to be made for the same post."[3] As long as the former post holder was still drawing a salary, the Treasury resisted paying the current post holder for that work, irrespective of what she might deserve. Most stand-in employees never attained a higher wage or any of the promotion opportunities attached to the higher post.

The arbitration tribunal heard the complaint and quickly ruled in the Treasury's favor, preserving the current mode of operation. This practice exemplified the government's view of labor and pay equity in the mid-twentieth century: What mattered was what was most advantageous to the government as an embodiment of the state and its people, not what was most fair to the worker. In addition, with the marriage bar in place, most jobs that employed women had relied on turnover, rather than promotion, to cycle new workers in and older workers out. The government committee that had cautiously recommended the marriage bar's abolition in 1946 feared the disruptive effect the change would have on standard operating procedure, warning: "A decision to remove the marriage bar would also have complications of the utmost importance as regards the turnover of staff in the large routine grades which are *inevitably required* in the Civil Service. The amount of routine work is so great—and will continue to be so, in spite of increasing mechanization—that the Civil Service staff 'pyramid' is bound to have a very broad base, and *promotion to higher ranks cannot come to all*" (italics mine).[4]

The marriage bar had ensured that "a large number of women civil servants never enter the field of competition for promotion, since they resign on marriage after only a few years' service."[5] The bar had limited the career options available to women and encouraged managers to view them as black holes for career training regardless of how highly they scored on Civil Service exams, and removal of the bar did not automatically result in better prospects. Its removal could not undo ingrained patterns of labor discrimination or change the structure of the Civil Service, which relied heavily on low-level, high-turnover workers, especially to run its increasingly prevalent automated systems.

Without the turnover afforded by the bar, the proportion of available promotions in relation to workers was even further reduced. The government had feared that the effects of removing the marriage bar would be "violently resented" by male staff "whose prospects would thereby be

worsened."[6] To prevent this situation, new measures for dealing with the large feminized classes of workers needed to be instituted; an underclass of women workers was in fact a key building block of the Civil Service's supposed meritocracy.

Making matters worse, through the mid-1950s civil servants faced a situation made harsher by government wage restraints designed to bolster the economy and stave off inflation. While rationing and shortages lingered on, the government undertook an "economy campaign," reducing the numbers of civil servants and cutting hundreds of thousands of pounds from government expenditure. The Foreign Office, a typical Civil Service department, saw £200,000 slashed from its spending through a mixture of staff and spending cuts.[7]

During austerity, Britons faced conditions that had not been vastly improved by the coming of peace. Rationing of food, fuel, and consumer goods stretched on, making a return to prewar standards of living impossible. Particularly in London, where the largest numbers of government workers were concentrated, shortages of fuel led to disaster in the winter of 1952. The high sulfur content from nutty slack—the low-quality home heating coal that had just come off ration—combined with stagnant weather conditions to create a deadly week-long smog. The lack of visibility produced by the smog brought all air, river, and ground transport in and out of London to a virtual halt, blackening the air so badly that policemen had to lead buses through the streets with flashlights. The seriousness of the "fog" ultimately led to Britain's first Clean Air Act in 1956, but it also produced thousands of fatalities.[8] The reliance on this low-quality coal was caused by the government selling more expensive, cleaner-burning coal abroad to ease the state's difficult financial position. Government workers mourned for the "many more victims of 'nutty slack,' or whatever it is which is carrying off the over-fifties" in their annual departmental reports that year.[9]

Although the government defended cutbacks as necessary to national recovery, many civil servants saw the conditions as emblematic of a larger devaluation of their work: "It can safely be stated that the government's declared policy of wage restraint finds little sympathetic echo among civil servants, many of whom reflect a trifle bitterly that had they 'listened to their Dads,' they might all have been good little, rich little coal-miners on a five day week."[10] Workers in nationalized industries like coal gained improved hours and wages, whereas government office workers in supposedly "better" jobs were stuck with the same "emergency" work week of 45.5 hours without overtime that had been instituted during the war.[11]

Even in the early 1950s, these workers still had to work a half-day on Saturday, unlike most workers in private industry. "How pitying, too, the remarks of outside employees who regard civil servants as 'the poor souls who traipse up to town every Saturday' and how galling for the poor souls themselves, who often suffer two hours traveling for three hours' work," lamented a staff association.[12] Civil servants had long considered themselves at the top of the labor hierarchy because they were nonmanual, professional workers with prestigious, lifelong government jobs. Now, they found themselves struggling.

For women workers, who made up 48 percent of the service at war's end, these privations were even more acutely felt.[13] The repeated concession of equal pay in theory—but not in fact—deepened their hardship while underscoring the unfairness of government wage controls and inculcating a distrust of the pay-negotiating tribunal, the National Whitley Council. Deprived of the right to strike due to their position as agents of the state, civil servants relied on the National Whitley Council to negotiate their terms of employment. A body created specifically to arbitrate the concerns of government workers, it was supposed to represent both the workers' and the government's sides equally. In truth, the government—and particularly the Treasury—had significant control over the nominally impartial proceedings. For instance, for years the government repeatedly refused to negotiate on equal pay, asserting that it was not a claim for wage increases but rather a matter of national policy and therefore outside the purview of the Whitley Council.[14]

Both equal pay campaigners and the postwar Labour and Conservative governments recognized the need to deal with the ever-growing labor relations problem created by unequal pay.[15] However, although the expansion of a female labor force enhanced pressure for equal pay, this same growth swelled the government's potential expenditure if it conceded. Operating with the aid of American-backed reconstruction loans and stung by the 1949 devaluation of the pound, the government considered the issue extremely reluctantly. Unequal pay was a major boon to the government as it struggled to raise productivity and lower costs.

The estimated outlay for the entire Civil Service itself in 1948 was nearly £2 billion. The maximum cost of equal pay placed it at barely more than 1 percent of the budget.[16] The 1945–1951 Labour government considered itself unable to muster the estimated £13–£25 million for equal pay[17] while spending hundreds of millions of pounds laying the foundations for the creation of new social services[18] and even upward of £40 million on the Tanganyika groundnut scheme, which has gone down

in history as a classic example of a boondoggle.[19] That plan to grow nuts for oil in Africa was intended to solve the short-term problem of cooking oil rationing at home, but it was expensive and poorly thought-out. The government chose unsuitable areas of east Africa and sent wave after wave of men, supplies, and construction equipment. Even at the time, it seemed clear that the money hastily earmarked for the plan was little more than an expensive gamble. No nuts were ever grown since the British could not even successfully clear the land for farming. Dense vegetation destroyed the heavy machinery that had been transported to Africa specifically for the purpose. Given the relative costs, the argument that the government could simply not afford equal pay in the short term was disingenuous. Cultural priorities as well as economic factors determined the governmental response to the equal pay campaign.

Computer Labor before "Computers"

Prior to the widespread use of electronic computers, the machines used by the Civil Service were placed into four general categories: desktop accounting machines; punched card collators, tabulators, and punches; typewriters; and printing machines. The higher-volume and more complex recordkeeping required by the welfare state made government data processing ever more important to the national good. These machines were mostly electromechanical (rather than mechanical), and their forms ranged from desktop sized (for typing, punching, and certain accounting machines) to furniture sized (for punched card tabulators, collators, and output or reproduction machines). Most of the data crunched relied on large, room-sized punched card installations where operators moved from machine to machine. Tabulator and collator operators would work standing, sometimes overseen by multiple supervisors who might be women or men. Meanwhile, the women performing data input generally worked seated in large pools, overseen by a woman supervisor.

By the 1950s, when *Office Machinery* magazine declared that the accounting machine represented "the logical progression from the era of the typewriter and adding machine as separate entities," office machine work had become more complex than either typing or accountancy alone.[20] The work was envisioned as being limited and easy to train for, despite the reality that it required better-than-average levels of education.[21] Hiring managers sought women exclusively, and the jobs sustained low wages and limited promotion prospects. "Women operate these machines," assured one Powers-Samas article in a company magazine,

Figure 2.1
Later images of "Powers Girls" showed the advance of electromechanical, and then electronic, computing. *Vickers News*, January 1951.

adding that they handled "payroll and works statistics with great facility."[22] Company literature used both text and photographs to give managers a detailed picture of how women would handle every step in the data-processing chain.

The process of programming the electromechanical computers in punched card installations involved plugging up a board that either was attached to the machine or could be swapped in and out, allowing operators to quickly run programs they had set up on other boards. "Plugging a board is a fairly skilled operation that involves the connection of

perhaps scores of leads, all of which must be put in the correct hole," wrote a consultant in a management and methods magazine.[23] In this sense, the plugboard-based programming was similar to the programming work done by WRNS working on the Colossus computers during the war, and the programming done by the ENIAC women.

After the machines were set up, operating staff loaded data on punch cards into a sorter, feeding in a specific series of control cards that contained instructions on how to sort and manipulate the data on the bulk of the cards. Cards were sorted at a rate of hundreds per minute using distractingly noisy machines. Made of a high-quality stock that could make several hundred passes through sorting and tabulating machines, these data cards had to be imported until the 1930s because British manufacturers were unable to produce cards of a sufficient quality.[24] Once the cards were sorted, women fed them in batches into an electromechanical tabulator that stored amounts in counters before recording the output to punched cards, paper tape, or, in some cases, a printer. In most punched card installations, employees rotated between tasks, except for the largest installations, where dedicated data-input staff was kept separate from other workers. Women data librarians kept the cards organized and filed for storage when a data set was not in use for a job, forming a kind of external, card-based computer memory bank.

At the most basic level, the data-processing chain for a punched card installation began with the process of transferring data onto cards from written lists or slips. Accounting information, civil engineering data, and customer profiles were just a few of the types of information sets that might be prepared. Through the use of punch machines with spring-loaded knife mechanisms, plus automatic feed and ejection, punchers could attain incredibly fast speeds of 300–400 forty-five-column cards per hour—or more than six cards per minute. Many workers could punch six holes per second, at an error rate of under 3 percent.[25] Packed into huge, factory-like rooms with dozens of other punchers, these women had to be able to tolerate noise and distraction while performing monotonous work accurately at a consistently high speed; it was crucial to the entire data-processing chain that punchers' work be virtually error-free. A low rate of error was a critical prerequisite to the functioning of massive data-handling systems, and therefore the lowly job of punching actually defined what was possible at the higher levels of automated work systems. Within the government, everything from auditing to the timely production of payroll, and from scientific analysis to economic

forecasting relied on punchers' accuracy and speed. Even so, management believed punching did not require much intelligence or intellect and treated punchers accordingly.[26]

The Fiction of Deskilling

A government-wide inquiry found, to its surprise, that better-educated "grammar school girls" made much better punchers, able to produce consistently more characters per hour with higher accuracy.[27] Grammar schools, the more academically rigorous option for students within the state-run school system, generally helped boys move on to professional work or university. One accounting department supervisor wrote of his punchers: "Oddly enough the brightest manually, as well as mentally, came from the Harrowgate and Knaresborough grammar schools whereas girls coming from shop counter experience and from the council schools were less adaptable."[28]

Mounted by the Treasury, this investigation sought to determine whether the lack of manual dexterity tests in the Civil Service exams for young women candidates had caused the government to be "embarrassingly let down by getting girls who were naturally left handed or otherwise not trainable to machine efficiency."[29] It compiled detailed information on machines in use, the average speed of the operators, the average error rates, and the length of training required for maximum efficiency. The focus of the inquiry was on basic tests of dexterity, but the Treasury was surprised to find how much of a difference to punching speed and accuracy a better education made.[30] Although these jobs were seen as manual, the Treasury inquiry found they had an important intellectual component.[31]

Even so, the Treasury continued to see machine work as inferior, despite the fact that its findings showed the work required more than just vocational training.[32] Clerical workers resisted being downgraded to these jobs, particularly disliking the hectic, unforgiving job of punch operator: "There were several cases where Clerical Assistants proved to be definitely allergic to machine duties and it was found almost impossible to turn them into mediocre operators," noted one investigator.[33] Paradoxically, the less competent women civil servants who were unable to perform keypunch work to the high standard required were literally promoted out of it, into clerical jobs that came with higher status, better working conditions, and more opportunities for promotion. "The utterly useless from a machine point of view were not so numerous that they

could not be absorbed into general low level clerical duties," wrote an executive in the Post Office Savings Bank's large accounting department.[34]

Training and time to reach maximum efficiency on accounting, punched card, and other machines varied from one month to six weeks, and the operators for each machine were far from interchangeable, due both to training and innate skills. Certain machines required workers with particular aptitudes, often referred to as "temperaments" in government documents discussing the selection of women employees: "Care is and has always been taken in choosing suitable officers to operate overprinting machines," for instance, noted the Post Office, because "the officers selected [are] required not only to be manually dexterous, but to be of a calm, steady nature and ... in fact temperamentally suited to get the best results from the machines."[35] Punchers, meanwhile, had to be able to tolerate noisy, boring, and monotonous work while remaining fast and accurate. When describing women workers, managers cloaked discussion of skill and talent in the language of temperament, subtly downgrading women's abilities by using language that implied emotional rather than intellectual suitability for the job.

Machine operators were largely ineligible for the pension benefits available to civil servants until the mid-1950s.[36] "Establishment" examinations, whose successful passage determined pension eligibility, were only given every five years for machine workers. This led one supervisor in the Stationery Office, which employed a large number of machine operators, to complain that operators were unfairly being treated as de facto temporary workers, warning that this fact could soon "detract from efficiency and output."[37] Positioning these jobs as transient had short-term economic benefits but created long-term problems in the forms of high turnover and constant retraining and reorganization.

By the early 1950s, an estimated one-third of all working Britons—close to 7.5 million people—were women, and many in the middle class and sometimes working class gravitated to higher-status, cleaner, and often better-paid work in offices.[38] Even well into the twentieth century, working as a domestic servant was one of the most likely jobs for a woman.[39] Women could work in factories, but entry into skilled trades was primarily reserved for boys. In 1951, only one in fifteen girls entering the workforce was apprenticed to a trade, whereas one in three boys apprenticed.[40] In this context, clerical work had growing potential as a career path for women, and many sought the higher-paying, more prestigious positions in the government's service.

Within the service, there was a huge range of of work. One could hold nearly any office job available in industry, and then some. Government clerical workers provided labor for the Post Office, which controlled the majority of British telecommunications through 1981 and was a testing site for much of the country's cutting-edge technology. The National Health Service also required ever-increasing numbers of administrative workers. The government employed nearly three quarters of a million workers in the Civil Service, well over double the number employed just two decades earlier and roughly three percent of the entire UK working population.[41] Despite increasing automation, the number of civil servants continued to rise. Long described as "a fair field with no favor," the service was supposed to eschew preference based on social standing by using a skills-based, examination-mediated meritocracy. Yet there were different qualifying examinations and different jobs to be examined for depending on whether the applicant was a man or a woman. Increasingly, the Civil Service began to institute a gendered class system built around computing work.[42]

The Mechanical Ceiling

The fact that machines were used to perform certain office work put that work slightly outside the pale of the supposedly clean and cerebral activities of the office. Women who performed machine work were regarded as more akin to light industrial workers than their clerical peers, alongside whom they worked and whose work responsibilities they often covered. This distinction between clerical and subclerical work was unclear and permeable, but it defined pay and career prospects for the majority of women in government work—most women were concentrated in these lower-level clerical grades.

In early 1948, as agitation for equal pay roiled, the Treasury took broad and drastic steps to reorganize the structure of work in the Civil Service, consolidating a feminized underclass of machine workers and codifying that change in the service's rules and promotion structures. "It has been decided," relayed the first Treasury circular of the year, "to create a specialist class of machine operators within the clerical/subclerical group." The new machine operator class, comprised of several different Civil Service job grades, would be an official women's class employed primarily on so-called subclerical work. "The duties of the class will cover all work on calculating, punch card, and accounting machines and will range from the simplest to the most complex work," announced the memorandum introducing the change.[43]

At first glance, this recategorization might not seem like a drastic or particularly important change. Women were already gathered near the bottom of the labor hierarchy. But in fact the Treasury's decision altered the work that women were allowed to do in the Civil Service and how that work was valued. Anticipating the spiraling costs that equal pay might soon bring, the Treasury saw a need to keep women's wages depressed as the number of women employees grew, buoyed by the growth of automated systems. With its service-wide organizational oversight powers, the Treasury created a broad new work category to consolidate many feminized job classes into one, and formally separate them from the rest of the service's meritocratic, exam-mediated hiring and promotion. This new class would have its own separate pay scales and limited promotion track. The reorganization would also have the effect of pulling women from higher classes of the service into a feminized, subclerical class of machine jobs. Most importantly, it would formalize women's previously informal association with calculation, data processing, and other computing work.

The new class would increase the number of positions for women machine workers so that instead of coming into the Civil Service as temporary clerks or clerical assistants as before, most women would now have one aspect of their work—machine operation—expanded to signify their entire job. Because machine operation was not as respected as clerical work, and often more specialized, the effect was to institutionalize women's isolation from the "real" work of offices in the very structure of how they were hired and trained. Machine work was defined in functional rather than intellectual terms. Women's work in the Civil Service, which varied widely—from accounting to surveying to payroll to scientific calculation—was now defined by the methods used to complete it rather than by its content.

Department heads were invited to apply to the Treasury for permission to use this new job category not only for new hiring but also to "re-grade" their existing staff. Only the lowest, most entry-level rung of the class, however—the machine assistant grade—had been instituted at the time of the announcement. This meant all machine operators would start at the bottom of the new job class, regardless of their level of experience. Only later, when the higher levels within the machine operator class were decided upon, would there be the possibility for workers to apply for a job title and pay that reflected their experience. The tactic set up the machine operator class from the outset as a job category designed to deskill workers and depress wages.

Although government reports referred to the great mass of their women workers as doing the "monotonous routine work" that made up the broad base of the Civil Service "pyramid," inquiries into the exact content and nature of machine operation commissioned by the Treasury itself repeatedly contradicted the characterizations of it as deskilled work.[44] These reports showed how machine workers needed many of the same skill sets as higher clerical workers and how machine operation jobs were best performed by higher-skill, more educated workers. Even machine workers at the lowest levels, who dealt with narrowly specialized calculations, possessed similar skills as clerical workers: "The lower grades of the technical part of the engineering field and the [scientific] Assistants are both fairly close to the Clerical Class in many respects," admitted an internal Treasury memo.[45] Despite this, most women workers were now partitioned off from the higher-status clerical class.[46]

Eventually, the machine operator class would have three levels: The entry-level rung was the position of machine assistant. The middle rung of machine operator, took on more complex work. Women would rise to machine operator in their midtwenties. The top grade was senior machine operator. These women would perform the most complicated work in the class, including programming and systems analysis. The expectation was for women to attain that rank in their later twenties or early thirties, because at that point promotion and pay increases ceased—much earlier than for workers in clerical jobs. The structure of the new class enforced a shortened, dead-end career, partly because of the idea that women should leave by this point to get married and take care of a family, but also as a reflection of the low worth accorded to this work. Many Civil Service leaders in this era could not conceive of technical or machine-aided office work as interesting, as complex, or as providing preparation for higher work. The fact that the association of women with machine work in offices had initially evolved from women's association with typewriters helped reinforce this attitude.[47] Yet the machine class was not simply a reflection of the status quo. It was the Treasury's attempt to deal with rising numbers of women employees by reorganizing the government's postwar workforce.

Machine operators who worked in large data-handling sections of fifty machine operators or more were supposed to form the core of the grade. Initially, the Treasury leaders who designed and instituted it claimed that "the class will be introduced only where large blocks of staff are regularly engaged on machine duties."[48] In practice, however, this guideline soon broke down. Because the Treasury saw this reorganization as a cost-saving

measure, machine operator grading was applied wherever women were employed on automated or even partially automated work. As such, the grading could be applied to women workers virtually anywhere. Even the memorandum announcing the change had stated that the number fifty was meant only as a "very rough guide" and that "the fifty need not all be located in one centre."[49] The specialized nature of the grade meant that there was virtually no hope of transferring out of it, especially as machine work grew in relation to clerical work. More machine operators were required every day, and few civil servants preferred this work.

In industry, women tried to escape such strictures through trade union action. Similarly, staff associations in the service attempted to protest these new categories. Within the Civil Service, two women's clerical associations had broken away from the main civil servants' union and amalgamated into the National Association of Women Civil Servants (NAWCS). The NAWCS formed in 1932 in response to a reorganization of the Civil Service that created a separate and unequal selection process for women recruits, and formalized lower pay for women working in the same grades as men. The NAWCS found itself confronting a similar instance of structural discrimination with the machine grades, but the NAWCS did not have enough members to make it a powerful pressure group. Because the group had split off from the main union run by men, new women civil servants could choose to join either group. Many opted for the larger, more powerful union run by men, the Civil Service Clerical Association (CSCA).[50]

The obstruction of the more powerful CSCA proved to be a major stumbling block. The NAWCS had spent the interwar and war years agitating for increases in pay and benefits, for mandatory placement of young men into the lowest all-women's grades, and had fought for pension and other rights for the all-women typing grades. In 1948, the government agreed to open certain all-male grades in the Post Office to women after negotiations with the NAWCS, but the CSCA, which had official negotiating rights for those grades, refused, continuing a pattern of antipathy toward equal pay and equal opportunity reforms.[51] CSCA leaders believed opening these grades to women threatened the status of male workers in those jobs and were apoplectic that the NAWCS continually went against what they felt should be a closed-shop negotiating situation with the government. A similar conflict occurred with the typing grades. In that case, the NAWCS had formal negotiating rights, but when they secured concessions from Civil Service management, the CSCA refused to agree to many of the changes, instead trying to trade

the typists' improvements to secure pay raises for other job classes that would benefit more men than women.

This intraworkforce animosity delayed long-awaited pay raises for typists for another several years, and even once the pay raises were gained, the two associations continued to argue over them. The CSCA issued a vituperative pamphlet, reprinted in the office journal sent to all civil servants, that insisted the efforts of the NAWCS on behalf of women in the typing grades had been worthless. Entitled "Who Did the Job? A History of the Recent Typing Structure Negotiations with Documentary Evidence," it was a scathing indictment of the NAWCS, which CSCA leaders alleged had no power as a negotiating body and had willfully misled women workers.[52]

Because the NAWCS focused on fighting for equal treatment for women, it was repeatedly squeezed out of labor negotiations, and the interests of the women's grades were never prioritized within the CSCA. Nonetheless, the NAWCS protected women workers in ways the CSCA never even attempted, in particular by keeping gendered labor-force segregation front and center as an issue. Yet the National Whitley Council refused to arbitrate any complaints about unequal pay throughout this period: "No claim, however based, may be taken to arbitration if it includes a demand for the same rate for men and women," declared the council.[53]

Raising Productivity through Lowering Pay: The Trouble with Gendered Scientific Management

Anne Godwin, a delegate of the national Trades Union Congress, called job segregation tactics like these a "persistent feature" of devaluing women's work. She lambasted "the practice of fixing the rate for a job and applying it to male workers only, as though they alone were the genuine workers on the job," thus depressing women's wages.[54] Although lower pay marked women as second-class workers, it also meant their labor was in high demand when employers tried to raise productivity by cutting labor costs. Women were considered a suitably "less expensive alternative" because they received only 75 percent of the men's rate in central government offices and 63 percent in local government offices.[55] As faster and more complex office automating machinery solidified machine operators' key role within the lower reaches of the government hierarchy, the machine grades helped produce economies that the government was unwilling to give up. Perhaps fittingly, Prime Minister Winston

Churchill—who returned to power in 1951—again presided over a period in which women's labor was deployed as a tool to help the state survive. This time, the organized devaluation of women's work helped the government survive austerity, much as it had helped the government survive the turmoil of war.

However, women were not used for all jobs in which cost savings could accrue—even in machine operation. For example, managers decided to use men for teleprinter jobs in the Admiralty, in part because the technology's newness gave it a higher status, but also because teleprinter transmissions to "highly paid Cable Company male operators at the other end of the circuits" meant that the "work should be regarded as being a much higher standard than that of a typist."[56] Yet teleprinters were simply typewriters that were hooked up to data transmission lines. Even though it was easier to attain the slower standard of speed required for teleprinter operation versus typing and it required less training than shorthand typing, teleprinter operation was nonetheless better paid. During labor shortages, women who were taken from typing duties and put on teleprinter duties were reluctant to return to typing, but were forced to on the basis that it was easier to train new staff for teleprinter operation rather than taking "excellent typists" and "squandering [them] on teleprinting."[57]

In the case of teleprinter operation, the newer technology and the immediacy and expense of the communications transfer contributed to the employer perception that teleprinter jobs required a higher level of responsibility. Whom workers would interact with defined the job as men's work more than its actual content. Teleprinter operation and typing were virtually identical. If anything, typing was more difficult because not only did it need to be performed faster and in higher volume, but typists also usually had to transcribe from dictation or scribbled notes. Women's lower labor cost hurt them in cases like this; it marked them as less valuable workers who could not be used for higher-status work. This, in turn, shaped staffing decisions.

As the machine operator class grew, machine operation jobs replaced most of the women's jobs in partially feminized job categories that had higher responsibility and better pay scales. Some department heads became unwilling to continue to pay and train women as anything other than machine operators: If they wanted to pay more for labor, they could have men instead, they reasoned. As a result, managers often gave women less interesting and responsible work, reflecting their lowered

status. Chasing ever-elusive productivity gains through lower labor costs sometimes backfired, however.

When the department that made the nation's official, highly detailed, and technical maps—the Ordnance Survey—Taylorized women's draftsmen and surveyor posts in their spheroidal trigonometry section in order to change them into machine operator jobs, the head of the section recoiled at the results. Although the section head had originally favored the idea as a way to get more staff, after seeing the change in practice he realized that the standards set out for machine operators were not "connected with the work our women do." Women competing for placements in the Civil Service under the examinations for machine operators were required to have different—and fewer—skills. Once he realized this, the section head felt "that the decision to re-grade our women as machine operators was an ill-advised one."

By deskilling women in the department who performed machine-aided calculation, their work actually became *less* efficient, and no money was saved as a result. "We have experienced more and more disadvantages of having these women as machine operators rather than as Surveyors, Draftswomen, or Computers ... Our work is at every stage closely linked with and dependent upon a full understanding of the technical process," the head of the spheroidal trigonometry section wrote. The new machine class workers, with their limited job mandate and lack of training, "could not be expected to participate" fully in the work, he added.[58] He described the new system as like having two men balancing different columns in a ledger: When a mistake arose, no one knew who was accountable or what went wrong. He now argued that all new women employees should "be either draftswomen or surveyors, so that they can undertake any work for which draftsmen and surveyors are normally employed" rather than being limited to machine operating work.[59]

In effect, the jobs for machine class workers had to be cut up into smaller pieces to make them suitable for this feminized grade, even though it was predominantly women who had been performing the work already. This situation shows the difference between labor feminization and work that is simply performed by women: True feminization entails deskilling, or at least the perception thereof. The problems in the spheroidal trigonometry section also highlight the differences among levels and intensities of labor feminization. The earlier surveyor, drafting, and calculating jobs for women had been feminized insofar as that they lacked some of the pay, promotion, and training opportunities men enjoyed in similar jobs, but when replaced with machine operators, the jobs had to

be explicitly redesigned to require less skill and autonomy. More intense forms of labor feminization mean not only that women are predominant and less well paid, but that this predominance leads to lower standards, lower prestige, and foreclosing of opportunities. As a historical process, feminization makes work less valuable as women become the majority of those doing it, setting up a vicious cycle in which workers' status drops further as the work becomes devalued, sometimes out of all proportion to the work's actual content.[60] Once this process has occurred, even men who return to these job categories are subject to the effects of labor feminization, meaning that feminization can affect workers of both genders negatively.

In response to the problems outlined by the head of the spheroidal trigonometry section, his superior replied: "I am not absolutely convinced that it is not possible to arrange the work in your Division [so] that there is adequate [work] to keep a staff of Machine Operators employed on duties appropriate to that class and thus enable a great proportion of your male staff to be employed on outside surveying duties."[61] By constructing the problem as one of organization of the department's work rather than a problem with the structure of the machine grades, he was able to throw the problem back to the lower-level manager and demand that intradepartmental reorganization rectify what was in fact a problem created by the organization of work service-wide. The "inflexibility and loss of responsibility" created by regrading the staff, however, was widely acknowledged within the department.[62]

In instituting the machine operator grade, the Ordnance Survey had made a calculated gamble. It had appealed to the Treasury's ongoing drive to hold down costs, suggesting that certain men could be replaced by women in order to gain more staff. If the section head of spheroidal trigonometry recategorized his employees as machine operators, he could immediately employ 35 percent more women and "release technical men for more appropriate survey duties," he argued. In entering into this deal to acquire more staff, he had realized he was taking a risk and had tried to impress upon the Treasury the "special character" of the work his women employees performed: "It includes reductions of theodolite observations, adjustments of triangulations by least square methods and the computation of coordinates from minor trig and traverse observations etc. ... These, I think you will agree are more difficult and call for more training than the use of the punching machines referred to specifically [in the circular]." He had also noted that the only way to get "suitable" women workers would be to offer some kind of career opportunity to them.[63]

The Treasury's opposing agenda to keep down costs, however, won out. Machine operators were placed in the department with little regard for the nature of the work, and soon after that the Treasury came back to inquire about "how many of the male Technical Civil Assistants could be replaced by women," hoping to cut costs further.[64] The Treasury only wished to institute the machine grade and authorize additional posts in a department if it meant a reduction in labor cost relative to output. Although the Ordnance Survey remained convinced that its machine operators needed to be of a higher caliber so that they could interact with and "be put on similar work to the male surveyor computers alongside whom they work," this was impossible under the initial rules of employment and training for the machine operator class. The Treasury had created a top-down structure in order to more easily manage, control, and pay for the growing number of women workers in government offices, and they would not be swayed by examples that seemed to contravene their new system.[65] Machine operation jobs were now explicitly given exclusively to women, usually young and single.[66] A once-informal practice had become formally institutionalized.

Limited opportunities in the expanding class began to have the effect of cutting short women's careers despite the repeal of the marriage bar. This low promotion ceiling caused women who deserved promotion to senior machine operator to be held back because of their young age: "Notwithstanding her outstanding ability, it would be unwise to absorb Miss Crook into the Senior Machine Operator Grade for a year or two," department managers agreed—and Miss Crook was not the only one.[67] One supervisor wrote that several of his senior machine operators had hit their pay and promotion maxima and had nowhere to go: "The four Senior Machine Operators employed in Trig Comps are unsuitable for employment in Level Comps now as their much greater skill would be wasted in Level Comps. Should they ~~marry~~ leave for any reason it would be necessary to replace them by well-qualified male or female surveyors with a good mathematical background who could then become efficient machine trig computers" (strikethrough in original).[68] As a result of the new machine operator class, high-skill women workers already in the service became trapped in a job category meant for low-skill workers. When they left the workforce, they were inevitably replaced by less well-trained workers, and departments were encouraged to Taylorize their work further to accommodate the new system, with little cost benefit. Departments that resisted, and women machine operators who picked up skills on the job that made them more valuable, threw the system into disarray.

The Machine Grades: Grassroots of the Equal Pay Campaign

This reconfiguration of women's work in concert with increasing automation inflamed sentiment in both the women's and men's Civil Service associations, although for different reasons. On the one hand, more women were being confined to low-level jobs. On the other hand, these women could replace men, depending on how departments organized their work. When the high price of the Civil Service pension, something most women did not collect, was factored in, Treasury leaders generally believed the government gained economically by replacing men with women despite the associated drawbacks of deskilling. This heightened the antagonistic relationship between the mixed gender but male-dominated CSCA and the smaller, all-women's NAWCS.

Labor organization along gendered lines was often difficult and inexpedient for women, yet it was sometimes the only way to make their voices heard. Within gender-integrated unions, men held most positions of power. After peaking in 1944, women's membership in the national Trades Union Congress (TUC) declined until 1947—but from 1951 to 1952, over ninety-eight thousand women joined the TUC in response to women trade unionists' massive recruiting campaign designed to appeal to women workers on the basis of issues specific to them.[69] In the Civil Service, however, the women's association increasingly struggled to attract enough new members to bolster its negotiating power.[70]

Meanwhile, the CSCA levied repeated complaints against the Ordnance Survey Department for a variety of issues related to machine operators' work. The CSCA, however, did not advocate on behalf of machine operators. Instead, it demanded that machine operators be given even less responsibility. Most offensive to the CSCA was the use of a limited number of senior machine operators as supervisory staff, particularly when the staff under their supervision included, or could potentially include, male workers. In a heated exchange, CSCA leaders complained that "clerical and technical employees using machines appear to be clashing badly," and that "definite lines of demarcation [are] needed to avoid serious repercussions."[71]

The CSCA believed it had been assured that the women of the machine operator grades would include no supervisor posts, even at the highest rank of senior machine operator. In order to placate the CSCA, the government acquiesced to these demands—and in fact went a step beyond, also preventing the few women executive officers in the managerial classes of the service from leading sections when men resented their supervision.

In some cases, "if it is proposed to put a female Executive Officer in charge I think it may cause trouble," wrote a Treasury official in reference to the skirmish with the CSCA, noting that due to an exception "under paragraph 14 a man may be in charge."[72]

Downgrading women so as not to anger men also applied to pay scales. Although men in the machine grades were nonexistent, the CSCA nonetheless negotiated a men's pay scale for the grade to protect their interests. The senior machine operator scale for men in 1953 started at £460, rising to £570, whereas women's pay started at £385 and grew by smaller, less frequent increments to £460.[73] The fact that women's pay maximum was the lowest salary point for men was not a coincidence, but rather an attempt to preserve clear gendered hierarchies, even in a class in which these hierarchies were only theoretical because there were no men, nor any structures in place to hire them. Senior machine operators' promotions were also held back on the grounds that it would be improper for a woman to attain such a post before she was twenty-eight to thirty years of age; otherwise, her pay might rise above a clerical officer of the same age. Because the latter job grade had a higher status, department heads worried that comparable pay would engender resentment and provoke requests for a clerical officer pay raise.[74] At the same time, the Treasury also wanted to delay machine operators' promotions in order to lower long-term outlay. Many machine operators would resign to marry before reaching maximum pay at age thirty.

Unfortunately, these tactics to restrain operators' promotion worked all too well. They meant that machine operators had to be willing to move wherever a vacancy was available in order to get promoted, and their current department had to agree to the loss of a now valuable, trained staff member. Making promotions more available became crucial for departments to be able to keep their skilled staff. Department heads were joined by the staff associations in pressing the Treasury to create more senior machine operator posts where they were needed. However, the Treasury was reluctant to do so. In long back-and-forth sessions, it haggled with departments that were straining to enact their own management vision in the face of the Treasury's strong top-down control.[75]

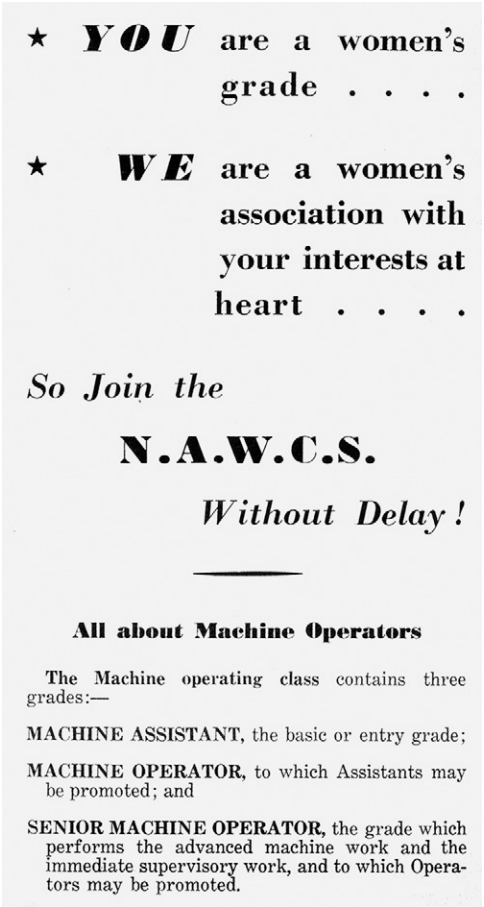
At the other end of the spectrum, some departments found themselves with machine operator redundancies and had to put their operators on nonmachine clerical tasks. The opposite situation also occurred, and higher-level women civil servants were sometimes demoted onto machine work simply because the amount of machine work in their departments increased. One complaint from the Institute of Professional Civil Servants

sought redress for the fact that several women who had been at a much higher rank in a different job class had been made to do machine work for over a year.[76]

Not surprisingly, the NAWCS had opposed the institution of the new machine operator grades, foreseeing that this categorization would condemn all women clerical workers to poorer career prospects. At their annual conference the year that the change was introduced, members expressed concern and sent a contingent to the Treasury to argue against the plan. They noted with alarm that the Treasury's plan contained another barb: Although men were not to be employed in this women's grade, the pay scales for theoretical male workers were only at the level of machine operator and senior machine operator, but not at the lowest grade of machine assistant. That grade was to be exclusively female, even in theory. This meant it had no possible comparison to a male wage and therefore could never attain equal pay, even if the government eventually agreed to raise women's pay up to the level of men who were doing the same job.[77] Machine assistants, at the lowest end of the scale, earned as little as £80 per year in the early 1950s, a salary that made dependence on family or a husband a necessity.[78] During her early twenties, by contrast, a machine operator would usually earn about £300 per year, making it a relatively high-paying position for young women before they hit the maximum pay, which was not much higher, a few years later. This was not unusual in jobs designed to attract young women workers who were expected to leave the workforce within a few years.[79]

As soon as the machine class was created, the NAWCS attempted to rally machine operators to "protect and promote their grade interests." Key to improving women's conditions in the Civil Service was being able to recruit women who were isolated from the channels of power in the service and were often temporary workers. A NAWCS pamphlet from the early 1950s pitched at machine workers proposed complete interchangeability between the machine grades and the more highly regarded clerical grades, asked for pay equality and equality of opportunity between men and women, and demanded that no subclerical grade be solely women. "You are a women's grade" and "We are a women's association with your interests at heart," declared the pamphlet, trying to rouse the machine grades to political action.[80]

As women flooded into more Civil Service jobs, the CSCA realized how dangerous the NAWCS could be if it successfully convinced more women civil servants to join together in pay negotiations separately from men. Arguing that the NAWCS was guilty of "misrepresentation added to



★ ***YOU*** **are a women's grade . . . .**

★ ***WE*** **are a women's association with your interests at heart . . . .**

So Join the

N.A.W.C.S.

Without Delay!

All about Machine Operators

The Machine operating class contains three grades:—

MACHINE ASSISTANT, the basic or entry grade;

MACHINE OPERATOR, to which Assistants may be promoted; and

SENIOR MACHINE OPERATOR, the grade which performs the advanced machine work and the immediate supervisory work, and to which Operators may be promoted.

Figure 2.2
Recruiting pamphlet from the National Association of Women Civil Servants targeting the machine grades, 1950.

incompetence," the CSCA inaccurately claimed it had negotiation rights for typists and attempted to convince the Treasury to negotiate only with them. To the CSCA's disappointment, the Treasury insisted on informing the NAWCS of the proposals under consideration.[81] Aside from this vocal in-fighting, the long-overdue and unusually large £40 raise granted to the typing grades in 1950 was perhaps the clearest signal that something was very wrong with the way feminized work was valued and remunerated in government. The 10 percent raise in a year during a period of austerity, when normally pay raises were on the level of 2–6 percent, hinted at how

depressed typists' wages had become and also how women's access to the negotiating process was increasing.

After the issue with the Ordnance Survey, the CSCA continued to police other departments' uses of senior machine operators. While the NAWCS argued for opening more opportunities for supervisory work to machine grade workers in the early 1950s, the CSCA sought the enforcement of job descriptions for women senior machine operators that expressly forbade such employees from supervising workers in nonfeminized grades.[82] The protection of higher-paying men's jobs influenced this complaint, but the anger seething through CSCA discussions on this topic reflected the idea that women supervising men was socially taboo. The fact that these women were lowly machine workers heightened the humiliation. Senior machine operators should not have even been allowed to supervise other women, the CSCA felt, since this would take a supervisory position away from a man.

The rising numbers of women machine workers, however, had already begun to transform the structure of the entire Civil Service. The NAWCS followed developments in government automation, fastidiously recording the numbers and types of computers on order and in use in government in their association's slim annual reports.[83] Although electronic computers had not yet replaced the electromechanical tabulating machines used for most government administration, the NAWCS recognized that electronics would soon take over, and strategized about how this change might be leveraged to improve women's opportunities. However, electromechanical installations shared many similarities with early electronic ones, making the changeover more evolutionary than revolutionary. Because punched card equipment formed the backbone of data handling within the Civil Service before the advent of electronic computing, it also defined the workflow and labor organization of later systems. As electronic systems began to replace electromechanical ones in the mid- to late 1950s, many women saw their computing jobs change very little, if at all. The same labor forces, with the same labor problems, carried over from electromechanical to electronic computing work.

As office-automation jobs became ever more numerous, raising the status of the office machine operator became the key to raising women workers' status overall. In 1957, the NAWCS-allied International Federation of Business and Professional Women devoted its annual conference to the topic of "Automation and the Individual" in an attempt to figure out what was to come and how women workers could best navigate the changing technological landscape.[84] Women labor leaders

mounted campaigns to try to situate machine operators firmly within the bounds of white-collar clerical work in order to support the idea that they deserved more respect. Yet although women computer operators were often portrayed as white collar in advertisements, in practice they resided slightly outside the world of the white-collar office worker. In fact, many operators covered their attire with coveralls while on the job, much like working-class laborers in more physically strenuous or dirty jobs might. Indeed, office automators explicitly took cues from earlier forms of industrial mechanization that had Taylorized jobs to utilize women's labor: "When we consider," one business computing specialist said, "the extent of automation in the factory, it seems that management has a right to expect the same degree of automation in the office."[85]

In figure 2.3, two women operate the same computer, the Power-Samas Electronic Multiplying Punch (EMP). The advertising image on the left shows a woman in crisp office attire operating a computer in a neatly closed case in a "push button" fashion, but the photo of an actual operator using the same machine shows the operator wearing coveralls and working with the machine's internals to set up the program. The advertising image shows the "black box" of computing technology closed

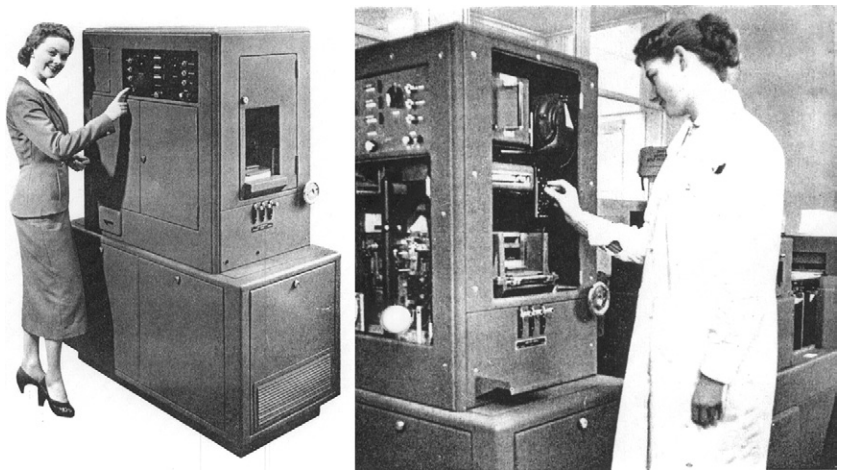


Figure 2.3
Two women operate an early electronic computer, the Power-Samas Electronic Multiplying Punch (EMP). The job and class status of each woman is presented very differently. In the advertising image (left) the worker appears more passive and white collar, while in the photo of an actual operator (right) she is more active and looks like a light industrial laborer. *Powers-Samas Magazine*, May–June and June–July 1957.

and positions the worker as a mere accessory, whereas the photo of a real computer worker shows that she must literally open the black box in order to perform her job, making her labor seem far more integral than peripheral.

Another computer company's staff magazine from the same year had a more comical take on women operators opening the black box. In a cartoon (figure 2.4), two operators dive in to fix their malfunctioning computer (note the prominently drawn vacuum tubes), while the maintenance engineer, just arrived on the scene, looks on in shock and dismay.[86] The cartoon plays on the complicated gendered expectations of computer work: Women could operate, manufacture, and test machines—all of that was firmly feminized labor—but they were not supposed to alter or fix their machines. These fine-grained job distinctions showed that the ways in which gendered work divisions were enforced had little to do with the work itself. In reality, these divisions were enforced by the different types of job training available for boys and girls. At their 1960 annual meeting, the Women's Trades Union Congress argued that "more trained

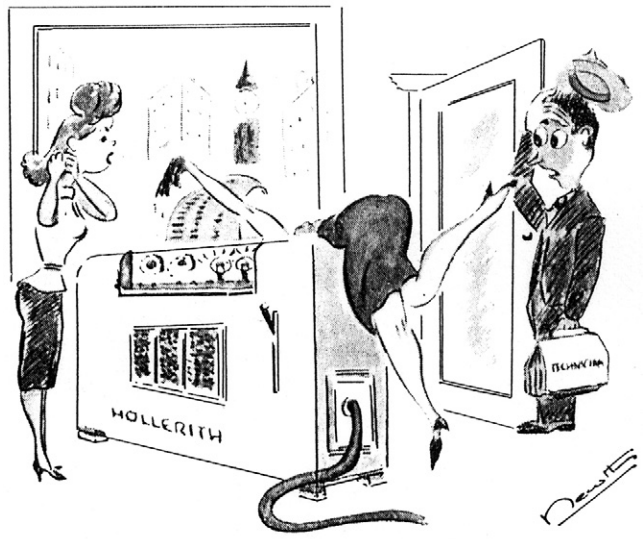


Figure 2.4
"Another Bobby Pin." Cartoon from *Tabacus: The Company Magazine of the British Tabulating Machine Company*, 1957.

technicians and technologists are required in this country and many girls are capable of qualifying for work of a technical character if given suitable opportunity," noting that women high school graduates were not needed as untrained, "cheap labor but as qualified technicians."[87] As the leaders of the TUC pointed out in a confidential internal memorandum: "The use of computers and other electronic devices has increased in large engineering companies and nationalized industries since 1958. ... Experience has shown that most work fed into these machines is prepared by female labor. This may be due to their manipulative skills but it is suspected that it is because it is a cheaper form of labor as 'equal pay *for work of equal value*' has not yet been established" (italics mine).[88]

From 1954 to 1958, the government installed eight electronic computers, mainly for scientific purposes.[89] In 1958, the Post Office installed its first electronic computer specifically for administrative purposes, and five other administrative computers were installed in other parts of the Civil Service that same year. All together, they cost close to £150,000.[90] Already hundreds of thousands of pounds had been spent on scientific and technical computers, but these dedicated administrative computers changed the focus of computing in government, turning the computer from a specialized scientific tool to a general-purpose information processing necessity.[91] By the end of the decade, there would be over a million pounds worth of computers in the central government; in the next decade, that figure would be multiplied nearly thirty-four times.[92] Yet these machines heralded the start of a new era in government mechanization in a technical sense only. They were not so much a break with the past as the continuation of plans to automate administrative work that had long been underway. For years, the leading business periodicals on office automation referred to "data processing—with or without computers" in talking about the patterns of office work that had paved the way for the introduction of electronic computing.[93]

Deserving and Undeserving Workers

While the proportion of women machine workers became ever greater, questions about their worth—and the worth of all women workers—began to take center stage. A section in the government's postwar report on equal pay had explained away the divisions between men and women in the Civil Service's "fair field with no favor" on the grounds of women's needs rather than the needs of their employers. Most women, the commission wrote, could not argue that they needed equal pay, whereas most

men had a valid claim to a higher wage because they shouldered a "moral responsibility ... backed by the sanction of law" for "founding and maintaining a family group."[94]

The government noted that the social effects of a widespread rise in women's wages "would be to improve the position of women in relation to men throughout employment generally."[95] This was not seen as a good thing. If women's position relative to men's rose, then it would put "a married man with a family in a relatively worse economic position than any other section of the community."[96] Treasury officials contended that their research showed single women already had a relatively higher standard of living on their lower government paycheck than single men had on their higher wage: "You would find that with a woman civil servant and a man civil servant on the same level, the woman can afford to take more expensive holidays than the man. She can go abroad. The man has to go and dig in his garden or perhaps snatch a week at Southend," a Treasury official claimed.[97] So persistent were these assertions that the Communist Party of Britain released an equal pay pamphlet, illustrated with cartoons of a large, imposing woman and a small, bookish man, that pointed out that women consumed goods in similar proportion to men and paid all the same prices for consumer goods and services, all on lower wages.[98]

The Equal Pay Commission—composed of four women and five men and chaired by Sir Cyril Asquith—had taken seriously the problem that equal pay could "create a sense of injustice in the men."[99] In their view, the typical working woman was a "spinster."[100] The image of the spinster was often a mirage, however. As the Industrial Health Research Board noted, many "spinsters" were women who might lose their jobs if their marriages were known. Married women were known to "conceal their marriages from their employers while others remained single in a legal sense only."[101] Many single women also had dependents. Mary Coombs, one of the earliest commercial computer programmers, recalled how her low salary meant severe hardship for her since she had to use a portion of her wages to support her mother.[102] By and large, the category of single women who had dependent children or other family members to support was not considered a valid group for inclusion in wage discussions, if they were even acknowledged to exist at all.

Arguing that work compensation for women should be seen in the light of need and social welfare, the government remained highly reluctant to accede to the idea of a "rate for the job" that would be paid to all holders of a given post irrespective of their social roles *outside* work. On

Beveridge's recommendations, the government took for granted a nuclear family supported by a male breadwinner wage, with women playing dependent roles both at home and in the labor market.[103] The findings of the Beveridge Report, which were to be the model for a progressive, postwar society, strengthened the long-standing connections between gendered wage policies and social services.[104]

Among temporary workers in government offices, 57 percent were women. In the lowest clerical category, clerical assistants, 55 percent were women. Only a handful of women worked in the higher grades of the Civil Service. The vast majority were confined to lower clerical posts, temporary positions, and machine operator jobs with little room to advance.[105] The clerical officer grade was only one-third women, whereas the next grade up, higher clerical officer, had just slightly more women members—an anomaly due to the large numbers of women who entered the workforce during and directly after World War I and never married due to the war's toll on their generation's men. Continuing up the job pyramid, the number of women declined to one-fifth of the executive class, and then to less than one-tenth of the administrative class.[106]

Arguments against equal pay often vacillated between saying women did not need higher pay and saying that they did not deserve it given their track record. Another reason women were ostensibly denied equal pay was because they were perceived as being less valuable and productive workers. Statistics suggested they were more likely to take sick days. Interestingly, the statistics gathered also showed that in the Civil Service, the higher the ranking and salary of a job, the lower women's average rate of absence was. In primarily women's professions, such as teaching, single women had an absence rate almost the same as men.[107] Women who did not work in male-dominated environments or at the lowest levels of the labor pyramid consistently took fewer sick days. The stressful nature of the jobs in the all-female machine grades may indeed have contributed to higher rates of illness—or at least a greater willingness to miss work whenever possible.[108]

In addition, the long-held management folk wisdom that women were effectively a waste of training because they would leave to have children played a major role in how the government regarded women workers: "It is evident to common sense that women workers do not regard their career as offering an alternative career to marriage and motherhood," stated a Department of Science and Industry report as late as 1961.[109] One woman applicant for a Post Office computing job in the 1960s recalled that she would not have gotten the job if she had not convinced

the hiring managers that she did not intend to have children, even though at the time she applied she was divorced.[110] Assumptions about women's ideal life patterns, as much or more than perceptions of their potential acumen, ensured that most women never joined the ranks of management or more skilled workers.

The flip side of this attitude was the conscious effort on the part of Civil Service officials to remove men from the lower grades through sometimes arbitrary promotion. "Male subclericals are a nuisance in several ways," noted one supervisor, expressing a representative opinion: The Treasury urged departments to hire men only as clerical officers. On the other hand, "for women, there might well be a separate selection and a separate quota," and it would be advisable "to fix either a maximum proportion for women or a minimum proportion for men in the Clerical Officer Selection," advised the Treasury.[111] Allowing men into feminized job categories would upset the balance of low pay and poor promotion prospects designed into those job classes. As a result, men were not only expected but also encouraged, through formal recruitment processes, to take the majority of higher, permanent posts in the service, and women were kept out.

Women assistant draftsmen, for example, "relieve skilled draftsman of routine work which does not require the full qualification of the grade of architectural and engineering draftsman." Men might filter through that job category, but only women were allowed to become permanent staff there. "Establishment in the grade of drawing office assistant is confined to women," the Equal Pay Commission explained, adding that "men are employed only as temporaries and only if the employing department is satisfied that there is scope for them to acquire the qualifications for entry to the draftsman grade."[112] Certain job grades positioned as only training for young men were set up to be permanent jobs for women.

Far from being a simple breakdown of meritocracy, this system was a major goal of effective industrial and governmental organization. It ensured that the people viewed as the most promising candidates, who were nearly always men, were given opportunities to succeed, on the assumption that reproducing the current hierarchy would keep the metaphorical machine of government running.[113] Stephanie Shirley, who worked for the government in this period as a scientific officer performing calculations, recalled how multiple men resigned their posts on the promotions board rather than have to deliberate on women's promotion applications because they "disapproved on principle of women holding managerial posts" regardless of qualifications. "What shocked me,"

Shirley stated, "was the more I became recognized as a serious young woman whose long-term aspirations went beyond a mere subservient role, the more violently I was resented and the more implacably I was kept in my place."[114]

Equal Pay versus Equal Value

As the fight for equal pay ramped up in the 1950s, labor activists had to contend with the difficult problem of how to define the concept itself. At the most basic level, equal pay could be defined as the practice of equalizing the wages earned by men and women in jobs with identical titles, but this definition left out a great many women workers, because gendered hiring practices and job categories segregated most women from men even within the same workplace. Equal opportunity in training and hiring became a major part of the campaign. In 1950, the NAWCS teamed with the National Union of Women Teachers (NUWT) to commission a short film on equal opportunity. Directed by feminist Jill Craigie, the film was rented to equal pay campaigners for public screenings, and it played along with newsreels in some London cinemas.[115] It attempted to show the problems inherent with the "same rate for the same job" model of equal pay and how the influx of women into the workplace in low-level jobs had stunted equality of opportunity. It dwelled on the hidden distinctions between people in the same workplace by contrasting the elevated status of certain white-collar jobs with the relative drudgery engaged in by many women office workers.

In an attempt to garner men's support, it also pointed out how various industrial processes had led to lower-paid women workers taking men's jobs: "In the old days, glass was mostly hand-blown, glassmaking was a man's world. Today it's manufactured, and the glass industry is largely a women's world. For women are cheap labor."[116] Using the example of feminization through industrial mechanization as a harbinger of things to come in white-collar professions, the film argued that equal pay and opportunity concerned every worker trying to protect his or her job. It culminated with the specter of international opprobrium: Britain had signed the UN charter on human rights that had guaranteed equal pay for equal work in the nations of signatories yet had failed to institute equal pay.[117]

By the late 1940s the British government had publicly and repeatedly affirmed their commitment to equality of pay in theory, even while declining to enact the principle. "As a broad affirmation of a general principle,

the government accept, as regards their own employees, the justice of the claim that there should be no difference in payment for the same work in respect of sex," stated the Chancellor of the Exchequer in 1947, adding nonetheless that "the government are definitely of the opinion that this principle cannot be applied at present time."[118] The assertion that Britain could not afford equal pay was not particular to austerity. Earlier, the same argument had been given for refusing equal pay in the decades after World War I. Such economic arguments were always enmeshed in a larger discourse of women's dependence within society.[119]

Seen as a "reserve" labor force whose low cost and elasticity in times of economic contraction benefited the state, women were one of the government's most effective tools for keeping the cost of their burgeoning public sector under control. From 1931 to 1955, the Civil Service had grown from 340,000 workers to 720,000, not counting the nationalized industries or the NHS.[120] Equal pay promised serious repercussions for the massive bureaucracies of the state, given the growing feminized labor forces on which they ran. As a result, the economic argument against equal pay continued to be put forward in the House of Commons right up until the passage of the Equal Pay Act. Even in the years after, economic hardship was given as the reason equal pay could not be granted all at once but instead needed to be phased in over several years. Both Labour and Conservative governments maintained this view of financial impossibility, despite adding more than the amount needed for equal pay to the wages of the Civil Service as a whole and presiding over an economic recovery from 1952 onward.[121]

Once again refusing to implement equal pay in early 1954, even while agreeing to it in principle, the Chancellor of the Exchequer quipped, "Like a good many things to do with women, this is entirely illogical."[122] If equal pay continued not to make financial sense to the government, however, it had begun to make more sense to trade unions. Trade unions began to foreground the need for equal pay in the mid-1950s, and the clerical associations in the Civil Service followed suit. Women's growing numbers had also shifted the labor dynamics of the public sector. This impressed upon staff association leaders the necessity of gaining equal pay so that men's salaries would not be undercut by the continued expansion of women's paid labor. If pay scales were not equalized before women workers gained a majority, CSCA leaders realized they would face an uphill battle in all future wage claims.

Once unions had made equal pay a priority in their wage claims, the campaigns orchestrated by national and local women's associations

Figure 2.5
Presenting the equal pay petition to Parliament, 1954. Courtesy of the Women's Library, London.

achieved a critical mass.[123] Petitions presented to the House of Commons in 1954, with over 1.3 million signatures, reflected the changing tide. After again delaying a vote on equal pay in the House of Commons in early 1954, the government finally entered into talks with staff through the National Whitley Council and quickly hammered out a plan for equal pay by early 1955. Under Atlee's Labour government, equal pay had been successfully held off. Ironically, it was under the Conservatives, during Churchill's second term as prime minister, that workers finally succeeded in gaining it.[124]

There was still far to go, however. The plan was for equal pay to be gradually implemented over the course of more than six years to protect the government from financial distress. By 1956, for instance, some women would gain as little as £5 toward their new pay rate, a tiny fraction of the total difference in pay.[125] Ultimately, though, the pay raises were phased in more quickly than laid out in the initial plans. Equal pay had not been so enormous a financial burden as the Treasury claimed after all. This was because the equal pay provisions paradoxically left untouched the vast majority of women who worked in the Civil Service.

The Excluded Grades and the Formation of a Machine Work Underclass

Most women in the Civil Service did not, in fact, gain equal pay in 1955, because the government had assented to the principle of the "rate for the job" only in those jobs in which men and women were employed in exactly the same job categories and, furthermore, in which the rate of pay for men was considered the "market rate" for the job. This meant that for job classes in which men formed the majority or a critical mass of those employed in a grade, the government raised women's pay up to the men's rate. However, because jobs in the Civil Service had for decades been divided by gender and many categories explicitly feminized, only a minority of women were employed in the same job classes as men. Fewer still had exactly the same job titles as men. The financial difference between interpreting equal pay as raising women's pay to the corresponding men's rate and raising women's pay to the corresponding men's rate only in cases where women were not the overwhelming majority of a job class was considerable. A whopping 54 percent of women civil servants would be left unaided by equal pay, because these women were employed in "grades confined to women."[126]

The Treasury argued that in job classes in which women made up most of the employees, they should not have their pay adjusted upward to the men's rates of pay, because in these situations women's pay was the market rate for the job. The machine operator class, which the Treasury had set up only six years earlier as an explicitly feminized grade, was by far the largest and fastest growing of these job classes. Even though the machine operator class had wage scales for men, they were not considered the market rate. Women had been doing the work long enough and in such huge majority that their lower value in the economy had transferred onto the work. The government argued that, for example, "in a situation where over 98 percent of our typists are female, the assessing of pay by reference to a male rate is highly artificial, and indeed, runs counter to the principle of fair comparisons [with industry]."[127] Because the market rate for this labor was depressed, the Treasury argued, it would not make sense to give women typists and machine operators equal pay.

In making this argument, however, the Treasury sidestepped the government's role as an economic and ethical bellwether: Equal pay in the public sector had not been meant to reflect private industry's practices but rather to help correct them. In the years following, the Treasury would dispense with the notion of "fair comparisons" as soon as labor shortages

in these ever-expanding, automation-adjacent job classes made it difficult to compete for workers.

Prior to the Equal Pay Act, these feminized job classes had been called "women's grades." However, the absurdity of the notion that the women's grades would not get any benefit from legislation designed specifically to help women seemed lost on the Treasury. After the passage of the act, the Treasury officially changed the name of the women's grades to the "excluded grades" to make clear, in the long term, their exclusion from equal pay provisions. As if by economic sleight of hand, the job classes in which women had been intentionally corralled and subjected to lower wages and poorer prospects had now become the ones in which women were seen to be receiving fair remuneration. This both reflected the rationale for government automation and encouraged its further extension. Women continued to flood into machine grade jobs, increasing the number of low-wage workers each year.

Some members of the machine classes, recently transferred from desk work to punching, verifying, and tabulating work, expressed great anger that they would not receive equal pay in their new positions. There was "a good deal of discontent among the machine operators," wrote one supervisor in the Transport Commission, "a number of whom have been specially selected for the work, having previously been on desk work, and had they remained on that work they would have automatically qualified for equal pay." He brought a complaint against the new wage structure on behalf of his employees, but his arguments were in vain.[128]

Now nominally gender neutral, the excluded grades were not simply a disappointment to women civil servants, but also a danger to men. The staff negotiating bodies quickly recognized that if in the future these job classes became gender integrated, it would result in depressed wages for men. The effect on wages would not only be felt by those within the excluded grades but also by those outside them, because salaries in the Civil Service operated on a strict system of "internal relativities," whereby remuneration in each job class was tied to all the others. In this way, the strong precedent equal pay set for the continued devaluation of women's work also set a precedent for devaluing men's work.

Machine grade jobs maintained complementary men's pay scales for many years afterward.[129] Although rarely if ever used, clerical associations had fought for men's scales in pay negotiations precisely for the purpose of trying to prevent the eventual depression of men's wages in feminized grades down to the rate for women. After equal pay, staff repeatedly brought pay complaints that argued for using the men's scales

in the machine grades as the true standard, trying to use these largely unused pay scales to raise women's pay. Clerical bodies persisted in shoehorning a few men civil servants into the excluded grades as test cases, each time rearguing the principle of equal pay. The government quickly rejected such claims, reiterating that "one of the arguments for paying lower scales of pay for the 'Excluded Grades' was that they were confined to women and that the work they performed was 'women's work.'" In fact, the staff association's complaints backfired because they caused the Treasury to officially state that the market rate for excluded grade jobs now applied to men as well. As a result, in any rare future case in which a man might work as a machine operator, he would no longer get the higher men's rate of pay. Making its position perfectly clear, the Treasury warned that it was "important that there should be an understanding that any man selected for an 'Excluded Grade' post should be paid no more than the 'Woman's' rate." Even though "both men and women do the jobs this will not be used in the future as ground for raising the scales of pay for 'Excluded Grades' up to those for 'equal pay' grades," the Treasury confirmed in a memorandum.[130]

Nevertheless, wage claims for machine work intensified, with staff representatives arguing that this work would "with the extension of mechanized accountancy and the development of electronics ... occupy an increasingly vital position in the general scheme of things." Dealing unfairly with machine workers threatened to become the next major point of contention within the Civil Service. Managers began to realize that "any difficulty which might arise in recruiting or retaining such staff could have serious repercussions on the whole scheme of mechanized accountancy."[131] Work that was barely white collar and viewed as rote and requiring little skill and ability now threatened to make up the most widespread and thereby most important job class in government. The respectability and importance of this work sat in constant tension with its devaluation—a situation that could not remain tenable for long.

The Aeronautical Research Council, considering the problems of making a long-term career path in computing for workers after equal pay, noted that "a high proportion of the [Scientific] Assistants are girls; this appears to be because they like the routine work." The council added that "the resignation of a large proportion on marriage certainly eases the problem of careers in computing." Nonetheless, it was starting to become an issue that machine-aided calculation work was a growing class of jobs from which men were cut off. The presence of a career trajectory could undo this feminization, reasoned managers. "Boys generally prefer

laboratory work to computing," the document continued, but "this might be due in part to the absence of any recognized career in computing and of any suitable specialist courses or qualifications." If a career path could be provided, the council wrote, then "it may be possible to make computing into an attractive career for some boys."[132] These efforts to broaden the labor pool would quickly run into problems, however, because of the jobs' feminized past. Even as the reach and importance of machine work in the office continued to grow, the labor force associated with it had become poorly paid and perceived as low skill and unprofessional, tanking the status of the jobs.

Toward the Electronic Office

The year that limited equal pay was granted, the government had only one electronic computer—but as the fifties drew to a close, there were over twenty, at a total cost of over a million pounds. In the next ten years, their cumulative cost would rise to over £36 million.[133] Foreseeing these spiraling costs, the Treasury worked to keep labor costs low by ensuring women's wages stayed depressed as their numbers, buoyed by the growth of automated systems, grew. By codifying the difference between machine workers and other office workers with the creation of the machine grades, the government formalized women's previously informal association with calculation, data processing, and other technical work. These changes in the Civil Service labor force would form the basis for the state's electronic computerization projects going forward.

In the same year equal pay was approved by the government, the ubiquitous nationwide bakery chain Lyons Teashops incorporated the division of its business that had three years earlier produced the world's first business computer: the Lyons Electronic Office, or LEO.[134] In 1951, Britain had gained the distinction of having invented the first electronic computer designed for business rather than scientific computing.[135] The LEO I provided a proof of concept for computers designed and built specifically for administrative use, and LEO Computers quickly became an early leader in British business computing. Computers like these would increasingly transform the national discourse on work productivity from the late 1950s onward.[136] Competing products evolved from Turing's ACE project, which formed the basis for English Electric's Deuce line of business computers, and computing research at Manchester University led to Ferranti's line of business and scientific computers. The LEO itself was created from the EDSAC computer developed at Cambridge.

Executives inside and outside the Civil Service saw that the government would soon be beholden to electronic computers for administrative tasks simply to keep pace with the ever-growing volume of data that government departments needed to handle. As early as 1956, when the government mounted fact-finding missions to the major corporations in the American electronic computing industry, government organizational experts came to believe that computers and the workers who operated them would become an exponentially greater part of a successful state bureaucracy, even to the point of affecting political governance.[137] "The Civil Service is likely to be affected far more than commercial concerns," noted *Office Magazine*, the main industry source for information on automation. "Indeed it probably has a greater need for commercial computers."[138]

This put the nation on track for a labor nightmare as machines were upgraded from electromechanical to electronic and began to play an ever-greater role within governance. The Treasury had reorganized the Civil Service to construct a class of low-cost machine workers divided from the rest of the service along gendered lines. This was a critical step in the process of government computerization, a way to heterogeneously engineer the labor force of the state to better accept the increasing automation of government. However, using equal pay legislation in the public sector to divide the workforce into clerical workers who deserved equal pay, and machine operators who did not, created a formal division between the feminized classes of workers that performed the critical calculation and tabulation work of the government's bureaucracies and the higher classes of workers in the government's bureaucracy that ostensibly oversaw this machine-aided work.

Far from being ancillary to questions of productivity and national progress in postwar Britain, equality of pay and opportunity for women were constituent issues in Britain's attempts to automate. Civil servants were part of a larger "government machine" in which they became components of a system of mechanized labor that ultimately sought to dispense with them altogether through ever-greater automation.[139] Women were the key, vital components of this machine because of how their socioeconomic position shaped their working lives in a way beneficial to employers. The Treasury recognized that because they could "no longer cut rates of pay ... one should think increasingly in terms of cutting down the number of workers by mechanization."[140] By this logic, the feminized machine classes were simply a step on the way to full automation—a human brake that would soon disappear. As the Treasury turned

its attention to electronic computers as a tool for cost reduction, believing that they were "likely to be the most important development in the field of government," they ignored the role that labor would have to play.[141] The intertwined nature of the history of equal pay and computerization made computer work low status going into the 1960s and had the added effect of creating computer labor shortages down the line.

In 1955, Anne Godwin, the head of the National Trades Union Congress for Women Workers, devoted her address at the annual meeting of all women trade unionists nationwide to the issue of office automation:

> It is generally thought that women replaced men in offices. They did not. They entered offices at a time when clerical employment was expanding through the speeding up of industrial processes and they took over the new machines, the typewriter and the telephone—and have developed their spheres of employment as machine operations in offices have expanded. Now a new development—the automatic electronic calculating machine—is emerging and threatens to open up a whole range of problems affecting not only the future employment of women in offices but men also.[142]

Godwin's words would prove prophetic. Even though the creation of a deskilled, feminized class of machine workers seemed to make sense from a short-term financial standpoint, greater automation would in fact require more workers—and more skilled workers—than the government expected. The labor model for data processing engineered by the state in this period presaged a postindustrial order in which gender and automation were interdependent categories. This structuring of automation around a feminized technical workforce would soon become a major stumbling block.

As the government expanded and upgraded the data-processing systems on which the public sector relied, its actions in the 1940s and 1950s created a situation in which a great mass of skilled workers had no recognition, authority, or avenues for promotion. The Treasury had brought into being an underclass of information workers who were functionaries of the state without having full civil rights, and a sphere of work whose importance was rapidly increasing out of all proportion with the value accorded to the workers who performed it. This prestige gap would shape not only computing labor within the public sector but also the government's computing projects themselves, and would ultimately affect the fortunes of the British computing industry. The institutionalization of this workforce as the template for modern, machine-dependent intellectual work became a foundational, and ultimately counterproductive, part of the coming computer "revolution."