

Gardey Delphine (2006), « Culture of Gender, Culture of Technology : the Gendering of Things in France's Office Spaces between 1890 and 1930 », in Novotny Helga (ed.), *Cultures of Technology*, Berghahn Books, New York, pp. 73-94.

CHAPTER 4

Culture of Gender, and Culture of Technology

The Gendering of Things in France's Office Spaces between 1890 and 1930

DELPHINE GARDEY*

In the wake of the Industrial Revolution the workplace has become a technological environment characterized by the presence of machines and other artifacts. Starting at the end of the nineteenth century, this feature of industrial spaces, and the worker's world more generally, spread to other areas of work, and to other sectors of the economy in Western capitalist societies. My research into office work and into the world of employees has been aimed at understanding the social, technological, and social changes that occurred in French offices starting in the 1890s. These changes took place in a context that was heavily influenced by the American model governing the rationalization of administrative work. A transformation contemporary to these others was the feminization of both the social group of office workers and the administrative tasks themselves, a development that is common to all of the Western capitalist economies and that seems to be irreversible.

Thus, the office was considerably transformed between the end of the nineteenth century and the 1940s, and I just want to underline three of these changes. Formerly a masculine world, it became a mixed world and then a feminine one. Second, the office as a world devoid of machines and defined in opposition to the technology associated with blue-collar workers, was reinvented as a largely mechanized one.¹ Third, the office changed from being a small world governed by interpersonal relationships to become a whole uni-

verse of work that generated its own complex hierarchies and that became the object for new methods of scientific management.²

To observe how both office work and the office employees “changed sex” during this period is a way of contributing to the analysis of the emergence of contemporary societies and of gaining a better understanding of them. The office is not an innocent space. Indeed, it is one of the places where a new era of work and economy as well as a new technological culture were invented. Furthermore, the changes that can be observed in the office during this period prefigure the transformation to the so-called information age that we are living through today. Indeed, between 1890 and 1930 one can see the instauration of a new framework, a new cognitive, material, human, and social infrastructure, which can be understood as signs of a first mechanical emergence of the information age.³ The fact that the development of this new technological environment has involved the invention of new types and new social roles for women is of major importance for the twentieth century. Women are the principle contributors to the new “tertiary,” “administrative,” or “digital” economy and form the bulk of its employees. The gender relations that are established in these emergent spaces and sociocultural contexts tend to persist, thus contributing to the instantiation of a certain order of gender relations at work, and in the rest of society. As a critical site for the comprehension of the history of women and women’s work in the twentieth century, the study of transformations in the office also allows us to contribute to historical and sociological studies that aim to understand how both gender and technology are mutually shaped.⁴

This chapter does not, however, aim to examine the macrosocial transformations taking place during this period,⁵ but rather to present a microstudy of the modalities governing the introduction of new artifacts and new types of people, in this case women, into the office. By means of different examples—shorthand and the typewriter, the sale of calculating machines, the technologies of control used by senior male employees, and so forth—I will explore how gender identity was elaborated as part of the same movement that introduced the relevant technologies. In order to understand how a technological environment—in this case a work environment—becomes gendered, I want to combine history and sociology. Although I will use a historical narrative to recount the process, I will also simultaneously deploy a sociology-based critical approach to technology. Of course, any historian who wants to work at the level of practices and micro-interactions is going to face difficulties due to a lack of appropriate sources. Nevertheless, I will try to take account of the authentically cultural dimension of the gendering of work technology by situating myself at the level of understanding as experienced by the objects and by the actors themselves. In order to see how the social and cultural dynamics involved in these accounts of the gendering of objects and technologies function, we need to understand how these novel technological and cultural

contexts not only emerge, but are also stabilized, and reproduce themselves.

My way of approaching such questions in this chapter is to suggest that we should take the question of objects and their sex seriously. Although we might think we know what the life cycle of an object is (conception, invention, fabrication, and commercialization), we generally underestimate the complexity of this process, the constant negotiations at each stage, as well as the wide diversity of the actors involved. Indeed, the idea of an object's linear life cycle should be rejected.⁶ The technological invention—and its legal form, the patent—rarely has any value in and of itself. As we know only too well, this value is established within the bundle of relationships and actions around the object. The real “interest” of the object only becomes apparent in practice, following its appropriation and reappropriation by groups of users, amateurs and professionals alike. Nor is the object's future primarily determined by the tension between consumers and market; rather it is invented in people's behavior, behavior that is intimate and/or idiosyncratic⁷ (Thévenot 1994), which is learned, standardized, and passed on (Gardey 1999).⁸ In this way, the users' desires and practices never cease to construct the objects as they modify them.⁹ It is in the course of these intricate histories, that the objects—that is to say the complex nodes of technology and society—sometimes acquire a sex. My aim is therefore to examine not only how technological objects shape cultural (and gender) roles, but also how and following what modalities technologies are “active” in reconfiguring the relationships. In other words, the fact that objects, like humans, “acquire” a sex contributes to the solidity of gender relations to their definition, their modification, and their solidification. Far from being a narrow and marginal perspective (i.e. viewed from the marginal or accessory perspective of women's lives and questions) this point of view enlarges our field of vision. Thus, it helps us to think about the relationships between humans and technologies, and it allows us to deepen our characterization of a society largely defined by the ubiquity of technological mediation. The goal is therefore to analyze how in intimate situations—the multiple moments and places where people and objects interact—technological practices are constructed, stabilized, and reconfigured, as well as to analyze how they contribute to the reproduction of social and cultural relations, in particular those associated with gender. According to the bulk of sociological and historical evidence, we are obliged to recognize gender as a relatively stable trait, with gender relations only varying to a minor degree.¹⁰ My hypothesis is that technologies and artifacts are decisive in the configuration of relationships of domination and act according to certain processes whose mechanisms need to be elucidated. Such a view allows us to conceptualize how constant changes or innovation (e.g., in technological artifacts and labor relations) can be reconciled with the permanence of masculine domination as the central social and cultural phenomenon.

The Power Attributed to Technology and the Naturalization of the Social

I would first like to consider the way in which technological artifacts are commonly considered as powerful, or the role in economic, social, and cultural transformation that is commonly attributed to them. The case of the typewriter is an interesting example since, for contemporaries and historians alike, it embodied the radical nature of the transformations in the office that occurred between the end of the nineteenth century and the beginning of the Second World War. As the emblem of such transformations, the typewriter has been assigned the role of "introducing women into the office." Today's popular wisdom continues to endorse the proclamations of the enthusiasts who declared as early as 1911 that the "typewriter has been the direct cause of one of the most tremendous revolutions witnessed by our times. To it we owe one of the greatest social upheavals ever: who would have suspected only ten years ago that a day would come when women would enter into the *prefecture*. If feminists have hearts, they will put up a statue to the inventor of typing."¹¹ The typist became a motif of modernity, criticized only by those retrograde spirits who refused to recognize an era full of promise in this new order (in terms of both technology and social relations between the sexes).

Thus, an external factor—the typewriter—seems to have brought about a key social transformation. Simply evoking this technological object serves as an adequate explanation. The history, we are told, is straightforward: originally there weren't any women in the office; then came the typewriter and with it came women.¹² The technological story provides a convenient response to the embarrassing question posed by the novel (and necessarily inopportune¹³) presence of a group of women not meant to work (because they were drawn from the middle classes), and occupying posts hitherto defined as masculine. How can one explain such a rupture in the cultural values and the morality of certain social groups? It is the evocation of a change in the order of objects, seen as desirable since they are synonymous with progress, which makes it possible to legitimate and naturalize the rupture introduced into the order of the social relations of gender. According to a common social interpretation of Darwinism, it is in the "nature of things" that a former technologically/naturally maladapted order should be replaced by another. Nevertheless, this kind of determinist discourse, like any implicitly naturalistic social theory, contributes just as much to the social and cultural change itself as it does to naturalizing the change once it has been brought about.

Many facts can be pointed to, which undermine this popular explanatory scenario. I have spent a lot of time establishing the presence of women in administrative positions before the introduction of the typewriter, and I have described in detail how in France the typewriter (the Sholes Typewriter manufactured by Remington) was originally adopted in the male milieu of the ste-

nographers and how these men, as the first typists, actively contributed to the definition of the use of this instrument in the business world.¹⁴ The common discourse remains unaffected by this evidence, no doubt testifying not only to the difficulty many have in admitting the relativity of the definition of masculine and feminine roles, but also to the local and changing nature of the assignment of technologies to one gender or the other, or even to their always-and-already social character. Thus, it seems necessary to deconstruct the way in which typing as a practice became associated with a certain definition of femininity, and to reconsider the joint engagement of people and objects in the construction of the social.

Let me give an example of how the link between women and the typewriter was locally and contingently built, how that construction was subsequently forgotten, and how the final situation was naturalized through the common notion of technological determinism: the typewriter simply brought women into the office. Two parallel and associated moves can be seen at the beginning of the story of the typewriter: on one hand, a process of the gendering of the object—the typewriter—and on the other hand, the cultural process of constructing the femininity of the practice of typing. The typewriter was gendered from the time it was first commercialized in the United States. Certain elements initially present by chance, but later recycled and reinterpreted, led to the identification of the typewriter as feminine. Remington's assembly of the first models in their sewing-machine workshops influenced the object's functionality and design, with the first models making use of a pedal to work the carriage return and sporting the cast-iron decoration and black arabesque paintwork common to both types of machine. The first typewriter catalog distributed by Remington in 1876 emphasized both this close relationship between the sewing machine and the typewriter and the "domestic" nature of the latter.¹⁵ Thus, the technological characteristics of the object themselves were constructed as "feminine," in particular, the sewing-machine decor, and the piano-style keyboard. The comparison between the technique of typing and playing the piano, which was continually reiterated in both the United States and France, fulfilled a function that becomes clear when one considers that it would be young middle-class women (whose principal pastimes included playing the piano and embroidery) who would become the first women typists. My point here is not to say whether or not the analogy between the piano and the typewriter keyboards is valid, one of several questions that divided successive generations of typists and specialists in the new sciences of work, but rather to assess the social and cultural effects of such an association. This association presented in a "technological" guise lent credibility to the idea that "shorthand-typing seems to have been created for young women" or that the typewriter was a feminine tool.

Inscribed potentially in the objects themselves, the sexual attributes of the users (be they the actual, planned, or desired users) are realized in the form of pos-

sible scenarios.¹⁶ Use and users are both configured in the context-dependent definition of a "good association" between people and objects, lending weight to the idea that social relations can be profoundly modified by the act of technological mediation. The construction of a new order is evidently based on this parallel and dialectical transformation of people and things. In this process, what appear to be commonsense discourses often play a key role. They participate in the naturalization of the transformations taking place, a reason for their being accepted as self-evident. In this case, we can see that there is a double discursive effect because the commonly held view also confirms a widely accepted conception of the performativity of technology. As David Edgerton¹⁷ has suggested, technological determinism, the thesis that technological innovation is the source of social change is essentially a highly "prized" "catchall label,"¹⁸ a theory of society that is itself socially effective. The repeated statement of the self-evidence of the association between women and typewriters is necessary at the beginning of the history, and becomes sufficient later on. Ultimately, it contributes to the construction of a reality¹⁹ by reiterating a profound and widely held conviction concerning the way in which the world is generated by its own transformations.

The Exchange of Properties between People and Objects: The Distribution and Attribution of Competencies

One notable feature of the discourse about the typewriter is how difficult it is to separate the descriptions of the machine from those of the worker. The integration of the human and the object sometimes seems so complete that it is impossible to identify either. This fact can be demonstrated in many ways, but it is possible to understand it by examining an episode in the history of the typewriter: the typing competition. When other manufacturers started to compete with Remington for the typewriter market, competitions between typists and typewriters started to be organized in both the United States and France, based on a range of different networks.²⁰ These "arenas" of typing virtuosity²¹ were necessarily places where extremely heterogeneous objects were put to the test (the context for these competitions was a nonstandardized market). They constituted regular, long-lasting laboratories for experimenting on practices and techniques. Here, as in the case of automobile races, both then and now, it seems difficult to tell who, between the driver, the vehicle, the team of technicians, or the manufacturer is the winner. Indeed, prizes in formula one racing are awarded to both the drivers and the team. Likewise, the typing competitions were just as much competitions between the manufacturers and their models—and the technological options that were successively adopted and incorporated in later models—as between the attitudes, postures, learning methods, techniques, and know-how of the participating typists.²² As

Bruno Latour suggests, it is possible to extract from this whole both "the properties taken from the social world in order to socialize the non-humans and the properties borrowed from the non-humans in order to 'naturalize' and develop the social world."²³ No doubt Latour is right, and we should thank him for having drawn our attention to the central place of artifacts in the constant rebuilding of the social. But that constant reconfiguration operates within quite strict boundaries (notably in the work situation), and the strong asymmetry in power relations means that objects regularly acquire similar roles. Let me take up the question of the assignment of qualities or capabilities to people and/or things in order to push this point a little further.

In a work situation, the distribution of capacities between humans and machines is not inconsequential but actively contributes to the definition of people's qualifications.²⁴ The evaluation of the respective worth of people and tools ultimately determines their salary, their place in the hierarchy of work, and, of course, their relative social position. Looked at, from this perspective, the advertisements from between the wars that aimed at commercializing modern office instruments (machines for reprographics, addressing mail, accounting, and calculating statistics) convey a clear message. Everything that is evoked concerning the technical features of these machines—necessarily full of promise for those writing the publicity—could be confused with the qualities expected from the ideal worker, in this case a female worker, the new protagonist on the administrative scene. The machines are personified, and the people objectified, assigned the lowly status of demonstrators, companions for the machines, which have now become auto/matic and auto/nomous. The whole business became literally diabolical when the "electricity fairy" became involved in a second wave of mechanization, which witnessed the triumph of the miniature electric motor with its "electro-accounting" and "electromagnetic synchronization."²⁵ Indeed, a "demon" was in control of the accounting machine, while for the calculating machine "the electricity fairy works wonders, greatly simplifying the different phases of the work."²⁶ Looking at the publicity for the "Multigraph," a strictly mechanical machine for copying correspondence, it is impossible to discern whether the terms in the slogan "precision, discretion, economy" refer to the physical virtues of the object or to the moral ones of its operator, a young woman and a new employee.²⁷ Ubiquitous but invisible, these women have their lifeblood drained by these superhuman machines to which they apply their skills now disguised as their loudly proclaimed natural capacities. It is no doubt that in this insidious mechanism we can locate an enduring and endlessly repeated feature that results in the negation of women's qualifications, a negation that feminist historians and sociologists of labor have continually uncovered in a variety of guises.²⁸ It has become clear that attributing properties to objects is not only the best means for naturalizing new social relations brought about by the objects, but is also the most powerful means for perpetually obscuring the qualifications of women workers and

even erasing the fact that they have any. It is a means to reaffirm, whatever the technological change, the invisibility of women at work, to obscure their skills and thus their social existence.

I believe it is possible to take the analysis of this mechanism further, and for this I return once again to the case of the typewriter. It is not just a coincidence that the analysis of the performance of the champions (both men and women) fed discussions on the efficiency of techniques and contributed to the development of typing norms.²⁹ Here, the champions' gestures constitute the matrix of professional norms, an essential reference point in discussions between specialists, thus rendering the sphere of sports or the arena of virtuosity a crucial one. The memory of this context has been lost, just as the champions' virtuosity was lost in the process of being transmitted, although it nevertheless remained as a horizon for future typists. It is an unconscious aspect of the good use of the object, a ubiquitous influence that guides the organization of action and the definition of the person as adapted or adaptable to this use. It appears then that old configurations around the use of an object could remain invisibly active in a new context.

The characterization of virtuosity remained a key issue at the beginning of the twentieth century. It is one of the subjects that were explored by Jean-Maurice Lahy, a member of a new French movement that was developing a science of work. Taking the sports analogy seriously, he installed the champion and the machine at the heart of his laboratory in order to carry out a series of observations ("objectified" by an array of electromagnetic recording devices). Speaking with authority derived from the power of this experimental array, he could claim to resolve the ongoing debates about typing practices (pandactylity, use of alternate hands or fingers, and keyboard layout). But Lahy also had a different objective, namely, countering the prescriptive and often reductionist Taylorist conception of work with a more comprehensive analysis of the "human factor" as it exhibits itself in diverse ways. Thus, his intention was not to render the practices and objects uniform, but rather to examine people's resources—the capacities they mobilize in their technical performances at work—with the aim of drawing conclusions about the recruitment and training of suitable professionals.³⁰

Several lessons can be drawn from these histories. The exchange of signs between objects and people forms an integral part of the construction of an object's use as well as its insertion into a fictional (workplace) scene that has yet to be realized, and so this phenomenon has great utility in the integration of technologies. In other words, these exchanges help to socialize "nonhumans" into the world of humans. Modalities governing these exchanges of qualities are not, however, immune from the influence of gender. In particular, the allocation of qualities to people and to objects allows the former to be discretely disqualified. Furthermore, it appears that during the period when the technological practices are not yet completely stabilized, the question of the distribu-

tion of capabilities between people and objects remains a central and open question as well as a source of disagreement. This issue is evident in what I have said about Lahy: the ergonomist's response was not the Taylorian one which, strongly aligned with upper management, spontaneously attributes the majority of qualities to objects: chronometer, machines, charts, graphs, and all sorts of other techniques aimed at "objectifying" the relations of production. Pointing to the question of the qualities of the objects versus those of the people ultimately tends to illuminate the crucial role of the people who are responsible for organizing the power of the objects. Thus, it is crucial to recall that objects are enrolled in organizational design.

Putting Things Back into Order: The Place of Women

Technologies as Organization?

Based on the previous discussion we might want to say that in the case of work, "to understand the technologies is 'to understand the organizations.'"³¹ This observation is accurate in several different respects. The stories that I have just told bear witness to the importance of the typewriter's "milieu" including manufacturers, publicists, and management scientists as well as champions of administrative reform and modern management techniques. The French employer's association for administrative management (*Chambre de l'Organisation commerciale*) brought many of these actors together in the form of texts, handbooks, periodicals, conferences, and seminars. More than just "neutral technicians," these actors were bound together in intimate interrelations. They elaborated "usage scenarios," which meant indiscriminately promoting both a technology and an associated organization. But, why did such a coupling come about? First, because objects were closely associated with ideas about organization. Second, because managers were convinced in the 1920s that organization (in the Taylorian sense of rationalization) and mechanization were two aspects of the same process. Third, because the general consensus was that machines exercised enduring power over places and people.³²

Dealing with the history of an object and its use, it is possible to show how open situations can become considerably restricted, and how technologies that a priori exercise a weak force de rappel (or constraint³³) can in the end be adapted in such a way as to dictate the movements of a worker quite precisely. Thus, in the case of the typewriter, the essence of the object was not initially defined, but the technological and organizational elements, the incorporation of practices and ways of doing things eventually led to a "closure" of the object. In other words, the human/technology interaction became governed by strong restrictions and prescriptions, which, although neither predictable nor conceivable at the outset, nevertheless depended heavily on power relations. The development of office equipment at the beginning of the twentieth cen-

tury, and the progressive equipping of the typists' workplace, which was very noticeable in the 1920s—the time when typing became a feminine profession—saw the furniture (typing chairs, special tables and later desks, adjustable lamps, and document holders) used to dictate the position of the body, the appropriateness of the gestures, and the correct way of using the object. Trained in the technique of memorizing the keyboard and the innumerable typing systems, the typist's sight was directed to the document, which was lit only at the point on which she needed to concentrate. The body was committed to the space in a specific manner, and coaxed into its actions by the equipment, which served as a veritable guide to the sanctioned gestures and rhythms. The furniture, however, *only* had a sense within an interlinked prior context that lent significance to this order. It was this context that made the typist behave in a way that was justified by professional precepts, scientific experiments, and wider considerations concerning what was appropriate for women. Thus, the commercial shorthand typist, polyvalent and male, ceded his place to a woman typist. In turn, she was progressively frozen in a pose that aimed at making a profit (or at bringing together a disparate set of factors that would allow the enterprise to be termed a success) on the investment represented by the purchase of the object. A bubble enveloped both the woman and the machine; the invisible strings that guided her hands and eyes were made not only from texts and rules, but also from the methods and postures she had learned. Under the objectifying eye of the manager, looking to establish the trueness of her rhythm as well as the quality and the productivity of her strokes, the incessant dialogue of "the woman and the machine" was transformed into a graph displaying efficiency and salary. A vehicle of emancipation in a specific context, the typewriter was progressively and paradoxically enlisted in a process that would help to determine and, in a literal sense, to delimit the body and the situation of women in the office world.³⁴

Technologies Apparently Without Organization:

The Indications for Use Inscribed in the Objects

Let us consider the autonomy and possible power of objects in more detail, independently from the issues of the organizational context.³⁵ Jean-Claude Kaufman,³⁶ in introducing a theory of domestic action, has clearly shown how we are socialized into the use of certain objects, not only with the help of our parents, but more generally with the help of the collective memory of previous generations, a part of which is "deposited" in the object itself. Thus we know (by training) that sharp things prick, while hollowed-out objects contain things. Danielle Chabaud-Rychter³⁷ has shown how innovators tend to retain the traditional forms of objects and the usual functions associated with them (in her case, food processors), and how unusual forms (emulsifying discs as a replacement for manual or electric whisks) run the risk of so disconcerting the users that they will not even begin to use them.

As for office work, the introduction of calculating machines provides an interesting case.³⁸ These instruments were offered to the world of business and administration in the 1910s as a series of heterogeneous objects without any clearly defined purpose. The advertisements initially targeted a wide range of users. The calculating machine was considered potentially useful not only for businesspeople, shopkeepers, and merchants but also for foremen on the factory floor while, in a research or design office setting, the draughtsman, technician, and engineer would all find it invaluable. Often strategically placed on the desk of the person who appears to be the "boss," the calculating machine was a rare object to be used only occasionally for particular tasks performed by particular people.³⁹ These features, which were common in the advertisements for most makes of calculating machine on the French market during the 1910s⁴⁰ and 1920s, were overturned by the publicity campaigns and promotional strategies mounted by Felt and Tarrant, the firm that commercialized the Comptometer. This calculating machine was aimed at women, in particular young women who had been specially trained in its use and were to occupy a new position in the office, that of "calculator." An advertisement from 1911 is quite explicit on this point, presenting a fictional scene as an invitation to organize the office along these particular lines.⁴¹ Mediating between a machine that possessed every possible virtue and the prestige of the accounting profession, whose elite remained entirely masculine, the young calculator was to play a (strictly minor) supporting role as the agreeable go-between. The advertisement tells us that in a single stroke the boss can achieve considerable savings (a young woman's salary is, by definition, a low one) while at the same time modernizing his service. Beyond the advertising copy, Felt and Tarrant had been actively aiding in the construction of this type of professional organization by training a number of calculators (both male and female) in its Comptometer schools.⁴² In the end, a specialized profession failed to develop around the use of the calculating machine; the tasks of mechanical calculation diversified and, during the interwar period, they were divided up between different categories of office personnel, both male and female. Nevertheless, there are some rare documents that bear witness to the existence of specialized calculating services, with pools of women calculators working on Comptometers.⁴³

The unusual manner in which the Comptometer was commercialized was linked to the cultural interpretation of the technological characteristics of this machine. Felt's Comptometer had successfully introduced the principle of the keyboard into the spectrum of machines capable of performing mechanical arithmetic operations, which included ones with cranks, carriages, and cursors.⁴⁴ This technical feature rendered the instrument "doubly automatic" (the keyboard allowed instant addition at the touch of a key, with subtraction effected by the addition of negative numbers) and constituted both an advantage and an enduring distinguishing feature in the calculating machine market.⁴⁵ Thus, the principle feature of the Comptometer was its keyboard, but the key-

board was more than just a shrewd and efficient interface between human beings and machine. This interface, which had proved decisive in the success story of the typewriter as a technological object,⁴⁶ had been progressively constructed as the privileged mode of interaction between women and machines. Although no doubt originally "neuter," the perception of the typewriter made the Comptometer's keyboard a feminine tool, particularly when it came to the promotion of the instrument as a piece of office equipment. Once in use, the Comptometer was ultimately situated in the same lineage as the typewriter, characterizing it as a feminized office technology, rather than in the heterogeneous and still nonstandard (in terms of technical and social options) calculating-machine market.

As we mentioned before, when people interact with objects, certain of the objects' properties provide indications for their use,⁴⁷ and it should be noted that these indications are more than just cognitive.⁴⁸ In the present case, the interface is not just operative, as it also incorporates cultural features, notably the definition of masculine and feminine roles. Elsewhere I have shown how the standardization of the typewriter keyboard was the result of a combination of technical choices and practices that had become constitutive of the definition of a professional group. What's more, technological artifacts seem decisive as vehicles of transmission. In other words, objects convey specific representations of scenes played out elsewhere and the "technical characteristics of the objects" may directly contribute to the naturalization of social relations. This kind of disposition of the object is normally only a potentiality, but when it is realized, it may very well enter into conflict with other features of the cultural or technological landscape.

Thus, while there were pools of women calculators, this manner of using the Comptometer calculating machine was not widely adopted as a way of organizing accounting. Two forces opposed its domination. The bookkeeper's work was an intimate mix of writing and calculation and did not lend itself to a separate extended phase of calculation. When a technical change occurs, changes in roles often turn out to be more complex than simply assigning the newer practices to the women who have just arrived. The tasks are distributed between men and women, between the old and the new equipment, and in the end, the combinations that are developed reflect the variety of ways of performing the relevant tasks, in this case: writing/calculation/machine/hand.⁴⁹ The limited development of calculator pools was also due to competition from accounting machines, an alternative technology that became available after the First World War. These machines allowed the "mechanical" performance of long sections of accounting work. Able to calculate, write, and duplicate several copies at the same time, accounting machines enjoyed a considerable vogue between the wars, particularly in large industrial firms and banks. All the same, women took charge of the "mechanical" side of the accounting work, while its preparation, oversight, and organization remained defined as masculine. This

new order of tasks, however, was again based—and this time successfully—on the ergonomics of the technological object, with its keyboard as the interface. The analogy between typing and typed-accounting or typed-invoicing was thus completely accepted by the professionals. This transfer of capabilities meant the negation of any presumed qualifications, and women typists—available in large numbers—were recruited to operate the accounting machines, reinforcing the idea that as far as the office was concerned women were permanently destined for the keyboard.⁵⁰

The True Technologies of Power: Reordering Gender Relations

One cannot understand the special nature of feminine practices and capabilities in the office without at the same time examining the way in which masculine tasks and functions were constituted, as well as the techniques and technologies aimed at men. Nor can one understand the power of technologies without pointing out how “technologies of command” at the office were put to use and how they were generally gendered masculine. During the interwar period, women assumed the majority of the mechanical tasks associated with administrative work. A survey in 1928 estimated that 70 percent of the employees who worked on office machines were women.⁵¹ The men, whether specialized employees or not, were characterized in the great majority by their exteriority to these new office technologies. It is important to note that, despite the technological and organizational transformations that had taken place in the office, they were thereby perpetuating the characteristic feature of the nineteenth-century office worker. This feature was a distance with respect to blue-collar workers and the workshop characterized by the ubiquity of technology and the reign of mechanization.⁵²

This is not to say that men did not make use of any technologies in the office. The development of large firms and organizations led to a diversification of positions in the hierarchy within the companies and their administrations.⁵³ A new class of male employees, whose vocation was to help manage increasingly large and complex groups, started to occupy intermediate positions in the managerial staff and to make use of completely new techniques and methods that we would today term management tools. These tools in turn contributed to the definition of their functions. I have already discussed how the calculating machine was implicated at the top of the accounting hierarchy, as well as in planning work. It was also involved in the preparation and inspection of production, and the determination of numerical indicators that could be useful for directing a firm's activity. Other examples of the “boss's” technologies were the telephone, the Dictaphone, the Automatic Superphone, the Telecall as well as all of the intangible technologies of command (knowledge

technologies and new cognitive aids, e.g., planners, graphs, and charts) that were intended to represent data and action.⁵⁴

Let's take the case of the telephone. The telephone industry in the United States and Europe initially developed as the provider of a business tool. The first telephone users and the first to be targeted as customers by the telephone companies were the businesspeople themselves, or their representatives in the firms.⁵⁵ Thus the early telephone industry in the United States was constructed around a persistent business-based couple. The couple consisted of the client, an upper class white man, and the hidden operator linked into the system, a single young woman from the educated middle class (only later would they be upwardly mobile lower-class women).⁵⁶ This "technosocial system" relied on the promise of human—and in this instance feminine—service, thereby distinguishing itself from the competing technology of the telegraph.⁵⁷ More than just switching machines, the operators were pleasant, invisible voices, which lent themselves to fantasies.⁵⁸ France shared in this history, witnessing the assignment of women to positions as operators, a movement acknowledged as early as 1890. This development mobilized women of analogous social backgrounds to their American counterparts with the corollary that in the department stores, firms, and banks telephonic functions also came to be defined as feminine. Thus, in the 1920s all of the telephone operators at the Renault factory were women, albeit from more modest backgrounds, and often alternating this with factory work.⁵⁹ Operators in telephone exchanges whether public or private, as well as those in firms were women who, although cogs in complex technosocial systems, were over the long term responsible for the connection of essentially masculine communications intended to construct the business world.⁶⁰ Actresses of the telephone, with their role self-evidently limited to that of workers, it was unimaginable (there are literally no images of these women) that they might use this tool themselves.

The representations of telephones in situ support this apparent self-evidence. The telephone rested on the manager's desk and was reserved for his exclusive use; it was a sign of his authority and power. The telephone was a means of communicating with his peers—for negotiation in particular—but above all it was an instrument of command. Within a strict framework that defined its use, the telephone authorized the pyramidal diffusion of commands, countermands, and recommendations. The question of the operability and efficiency of this control came to the fore during the 1930s in a context marked by the application of Taylorian orthodoxy to administrative work. New machines were proposed in order to resolve those questions. These "all-powerful" technologies served to dramatically increase the power of the men using them, and were aimed at neutralizing the "noise" generally associated with the people to whom they were being applied. At a time when telephone calls were more common and no longer strictly confined to the elite, the "Automatic Superphone" allowed the user to dispense with the operator and to

directly manage the communication in order both to prioritize calls and to keep them under surveillance. Made for the "boss," it aimed "to check the communications taking place," "to speak without any fear of indiscretion," and "to check what is being said on the phone."⁶¹ The questions of the asymmetry of oral communication and who was able to initiate it were indeed crucial, and machines were able to capitalize on them. Thus the Telecall was presented as a system of "wireless-amplified order transmitters" that could serve as a substitute for a private telephone service. It consisted of a voice amplifier that could transmit the boss's orders throughout his shops, workshops, or offices and allow the employees to respond. Promising to multiply the activity of "those who are paid the highest salaries," the Telecall allowed the coverage of an area as large as 600 m² (6,500 square feet—a Paris business of this size is used as an example in the advertisement) and so to "watch over, command, and control 300 underlings."⁶²

These machines for command and control were therefore "machines for constructing ubiquity." This capacity to be in several places at once, formerly restricted to divinities now became one of the boss's attributes. An advertisement promoting a silent typewriter emphasizes what characterizes a position of authority and command. While the (female) typist is silently and evidently discretely working away, the boss can "think, talk, or telephone" with the ease and satisfaction of someone who, finally liberated from the noise of his underlings' labor, is here and yet essentially elsewhere.⁶³ To be a boss is not to be disturbed; it is to be served and liberated by technology (and by others' work) rather than constrained by it. The reverse side of this relationship is the reciprocal allocation of machines to women and women to machines. Whereas the men selectively use the technologies that serve them, women serve the technology; either they are directly engaged with the machine in a joint productivist effort (typewriter, calculator, and accounting machines) or they are cogs in a techno-organizational complex that they extend through their participation, filling in the gaps in systems of communication or classification (telephone operators, or filing clerks fastened to chairs on tracks in large-scale filing services).

In order to illustrate this last point, I would like to cite the case of the marketing of the Dictaphone, the Parlographe, and other machines for dictating mail at the beginning of the twentieth century. Invented in 1888 by Edison, the phonograph (an instrument that allowed voices to be recorded and played back by means of a wax cylinder) seems to have been conceived as an efficient business tool. Based on this conception, and inspired by American publicity campaigns, a series of objects were launched in France during the 1910s. Advertisements for these dictation machines present images of couples, which serve to remind us that the relationship between the sexes is one of the key elements at stake in the introduction of this technology.⁶⁴ What is striking in the pictorial images is the contrast between the postures of the men who use

the technology (superior, and hierarchical) and those of the women, who one could term as being "in the service" of the technology.

For men, the commercial phonograph was liberating. Presented as a mechanical substitute for taking shorthand notes, the machine recorded the words of the office manager, the businessperson, or the boss whenever he wanted, without the inconvenience of having someone else in the room. "The Dictaphone always understands what you say ... never interrupts ... never gets annoyed ... never takes a break ... you can speak at your own pace ... it is always at your command."⁶⁵ A decisive, explicit point is that "the Dictaphone makes you completely independent from your staff." Thus we see men filling the frame of the image with a relaxed presence in poses that convey a rediscovered feeling of liberty and intimacy.⁶⁶ The corollary of this image, either hidden or else displayed in the background, is even more striking: row upon row of women in vast departments, working uninterrupted at the typed transcription of the texts recorded on the wax cylinders. Thus, masculine liberty has as its implicit or explicit counterpart the feminine enslavement of the "Ediphonists" who, earphones attached, sat behind a typewriter all day long. At Sears, Roebuck and Co. in Chicago during the 1910s these women were paid for their typing by the mile, a practice that was adopted by a Parisian insurance firm in 1938.⁶⁷ Here we see how the Dictaphone was directly "responsible" for novel ways of organizing typing work, patterns of organization that would later be advocated by partisans of Taylorism for other types of office work. In turn, certain people would interpret this development as an example of the proletarianization of office workers.⁶⁸

These various examples begin to trace the outlines of a particular cartography that maps the gendered organization of work and use of technologies. The main features of this map are the following: on the one hand immobility, sedentary work, being allocated tasks, and repetitiveness as appropriate for women; while on the other hand mobility, polyvalence, ubiquity and the instrumental use of technologies are constituted as masculine characteristics. The ways in which the bodies of both men and women relate to the objects, and the relationships between men, women, and space find themselves modified: women serve the technologies—seated, confined to the interior—while men use them, or rather are served by them—standing up, mobile, in communication with the outside world, with the possibility of going out there as well. In this *ménage à trois* (men/women/technology) women often come out the losers, mainly because machines seem to absorb their capabilities (in fact, their qualifications) while requalifying men (often realized in terms of power). These remarks lend support to the anthropological thesis put forward by Paola Tabet who points to the unequal relationship of men and women to technology as a key element in the reproduction of male domination. From the present case, we can conclude in a more limited sense that technologies offer men the possibility of expanding their influence over the real, while women are largely used as bodies, no longer a "driving force," but rather cogs in a machine

or machinery that they endlessly feed; all-consuming work that makes use of either women's "patience time"⁶⁹ or of their everyday virtuosity.

Conclusion

By focusing the analysis on the workplace and by closely examining gestures, practices, and the actors' relationships to technologies, I have been able to bring out the processes by which technologies, objects, and artifacts are gendered in the context of work. Beyond the analysis of how a person's sex is a resource that can be mobilized either consciously or unconsciously to organize or naturalize the differentiation of tasks within groups of workers, I have tried to communicate the less widespread, and less accessible idea according to which technology is decisive "in the consolidation or reformulation of unequal relations between genders."⁷⁰

The sexual differentiation of tasks, roles, and spheres of activity is a cultural feature that is paradoxically both universal and highly variable, always operating as it does according to local, contextual modalities. The nature of such differentiation depends on particular arrangements, and the historical narrative has allowed us to highlight certain mechanisms that underwrite them. In the case of the office, a space that was initially masculine, I have tried to show how this "gendering of objects" worked, a mechanism for gendering objects based on a double movement involving the redefinition (and requalification) of both the people and the objects. As I mentioned, the exchange of properties between people and objects illustrated time and time again, contributes to both the socialization of technology and to the definition of social and cultural roles. A mixture of technological and social innovation, this exchange of properties is also one of reinforcement or reaffirmation of social and gender stereotypes. In configuring technology for a use, the dynamic at work is largely conservative. Here, what is given as the neutral "order of things" erases its own social construction, and contributes to both the stabilization and the naturalization of a continually renewed social order, in this case the asymmetrical relationship between men and women.

In the end, the "true power" of objects seems to reside in its invisibility. The observers lose track of how the construction came about, as it is internalized in the disciplining of the body and mind, and is dispersed throughout the furnishing or equipment of space. From this perspective, the relationships of men's and women's bodies to the technologies they use in the workplace are often highly differentiated, and thus it is as important to study the culture of technology in this context as it is to account for the culture of the body (in relation to technology). Furthermore, the stabilization of a form of organization in the "order of things" means the reaffirmation of a sense of fatality, as well as the idea that both human will and initiative are powerless. This capacity of technology is at once discursive, material, and social. As I mentioned, the deter-

ministic discourse fulfills a useful social function not only in the explanation and legitimation but also in the naturalization of the changes taking place. From a completely different perspective, I tried to point out the generative capacity of technology, as social artifacts, able to transmit acquired forms from one generation of objects to another or from one context to another, sedimenting social scenarios that the actors may consciously or unconsciously re-activate. Nevertheless, I believe that it is important here to insist once again on the fact that there are numerous paradoxes in these histories that need to be brought out. The history of the feminization of the shorthand typing profession like that of the telephone operator provides an extreme case where it is possible to observe how “technology and innovation” (in the terms of propagandists) contribute to the invention of a new social role for women while at the same time confirming old ideas about women’s work.⁷¹ Innovation and the renewal of order, social change, and the reproduction of domination can go hand in hand.⁷²

The emergence of a radically new technological culture in the twentieth century, the technological culture of administration and information management based on mechanized writing and filing systems was not treated as a technological culture for quite some time, no doubt because it was a feminized culture, and one that did not impinge directly on the problematic of the working class. Feminist technology studies have not been limited to bringing the often unequal division of tasks and skills between women and men to light, but have also sought to show how the recognition of skills and qualifications as such, and of technology as culture have been shot through with gender bias. Although they were participants or more properly actors in these important technological innovations that have revolutionized the office in the course of the twentieth century, women office workers have not been appreciated as such, repeating yet again the destiny of women’s work to be neither recognized nor valued. Bearing this in mind, I believe it is crucial to valorize these places where a culture of women’s work was defined (not to essentialize such a culture, but rather to remind us of its constructed nature). Thus, my ultimate aim is to bring to light the contribution made by these women to the concrete development of contemporary society and economy.

Notes

* This chapter is a revised version of a text that originally appeared in French under the title “Humains et objets en action: essai sur la réification de la domination masculine”, in *L’engendrement des choses. Des hommes, des femmes et des techniques*, Danielle Chabaud-Rychter and Delphine Gardey, eds. (Paris, 2002).

1. However, the office possessed its own technologies before this period of mechanization, adding another source of complexity to the analysis.

2. Gardey, “Mechanizing Writing and Photographing the Word: Utopias, Office Work, and Stories of Gender and Technology,” *History and Technology* 17 (2001b): 319–52.

3. To use an expression of Manuel Castells, *The Rise of the Network Society*, 2nd ed. (Oxford and Malden, Mass., 2000 [1996]).

4. Such questions were initially formulated within the feminist critique of the sociology and history of labor: Chabaud-Rychter, Ghislaine Doniol-Shaw, Helen Harden-Chenut, "Division sexuelle des techniques et qualification," rapport de recherche Gedisst-CNRS (Paris, 1987); also Hélène Hirata and Chantal Rogerat, "Technologie, qualification et division sexuelle du travail," *Revue Française de Sociologie* 29 (1988); and Hirata and Danièle Kergoat, "La division sexuelle du travail revisitée," in *Les nouvelles frontières de l'inégalité. Hommes et femmes sur le marché du travail*, ed. Margaret Maruani (Paris, 1998), 94–104. And in historical studies, Ava Baron, ed., *Work Engendered, Toward a New History of American Labor* (Ithaca and London, 1991). For an overview of this literature see Chabaud-Rychter and Gardey, "Techniques et genre," in *Dictionnaire critique du féminisme*, eds. Hirata et al. (Paris, 2000). Since then, the mutual relationship between technology and gender became the main issue: see Judy Wajcman, *Feminism Confronts Technology*, (Cambridge, 1991).

5. For more on this issue, see Gardey's, in particular: Gardey, "Mechanizing Writing and photographing the Word, 319–52; and Gardey, *La dactylographe et l'expéditionnaire. Histoire des employés de bureau (1890–1930)* (Paris and Berlin, 2001a).

6. See Wiebe E. Bijker, Thomas P. Hughes, and Trevor Pinch, *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology* (Cambridge, Mass., 1987); and also Donald Mackenzie and Wajcman, eds., *The Social Shaping of Technology* (Bristol, England, 2000 [1985]). For an examination of these questions as they relate to the history of technology, see the special issue of *Annales*, Yves Cohen and Dominique Pestre Cohen, eds., "Histoire des techniques," *Annales, HSS*, nos. 4–5 (July–October, 1998).

7. Laurent Thévenot, "Le régime de familiarité: des choses en personne," *Genèses* 17 (September, 1994): 72–101.

8. For a broader consideration of the implication of objects in actions, see Bernard Conein, Nicolas Dodier, and Laurent Thévenot, "Les objets dans l'action," *Raisons Pratiques*, no. 4 (1993).

9. Cynthia Cockburn and Susan Ormrod, eds., *Gender and Technology in the Making* (London, 1993).

10. I feel that this is one of the issues (among others) in the discussion within the social sciences concerning gender that were raised in the debates around Pierre Bourdieu's *Domination masculine* (Paris, 1998). On this theme, see the debate in the journal *Travail, Genre et Sociétés*, no. 1 (1999): 201–34.

11. *Revue dactylographique et mécanique*, 1911.

12. For an analysis of the association of women/machines/modernity/progress at the end of the nineteenth and beginning of the twentieth centuries, see Michelle Perrot, "Machines fin de siècle," *Romantismes* 41 (1983): 5–17. Reprinted in Perrot, *Les femmes ou les silences de l'histoire* (Paris, 1998).

13. For more on the question of pioneers, see the collection of articles edited by Gardey on the subject in the journal *Travail, Genre et Sociétés*, no. 4 (2000b).

14. For a nondeterminist version of the history of the typewriter and the construction of the profession of the shorthand-typist see Gardey, "Mechanizing Writing and Photographing the Word," 319–52. For an analysis of the joint construction of a standardized market consisting of the typewriter and the associated professional practices see Gardey, "The Standardization of a Technical Practice; Typing (1883–1930)," *History and Technology* 15 (1999a): 313–43.

15. The definition of the sewing machine-object as domestic and its gendering as feminine have their own history that is addressed in Judith Coffin, "Credit, Consumption, and Images of Women's Desires: Selling the Sewing Machine in Late Nineteenth-Century France," *French Historical Studies* 18, no. 3 (Spring 1994): 749–83.

16. I have borrowed this notion from the work of Madeleine Akrich, "The De-Description of Technical Objects." In *Shaping Technology-Building Society*, eds. Bijker and John Law (Cambridge, Mass., 1992).

17. David Edgerton, "De l'innovation aux usages. Dix thèses éclectiques sur l'histoire des techniques," *Annales, HSS*, nos. 4–5 (July–October, 1998): 815–37.

18. For convenience, I have not used David Edgerton's vocabulary, which is aimed at differentiating between technological determinism and innovative determinism. According to him, innovative determinism is the usual version of technological determinism, and is a naively progressivist position. He opposes this position with the veritable challenge to examine how exactly a society is or isn't determined by the current technologies.

19. For discussions of this question in social history, see the work of Joan Scott, 'L'ouvrière! Mot impie, sordide ...', *Women Workers in the Discourse of French Political Economy, 1840–1860*, in *The Historical Meanings of Work*, ed. Patrick Joyce (Cambridge, 1987), 119–42. See also Laura Frader, "La division sexuelle du travail à la lumière des recherches historiques," *Cahiers du Mago* 3–4 (1995): 143–56.

20. In France, for example, typing competitions were grafted onto preexisting competitions between the proponents of rival stenographic methods. Frequent at the end of the nineteenth century, these competitions remained common even between the wars: Gardey, *La dactylographe et l'expéditionnaire*.

21. Here I am deliberately using terminology taken from Nicolas Dodier, "Les arènes des habiletés techniques," in Conein, Dodier, and Thévenot, "Objets dans l'action," 115–39.

22. Gardey, "Standardization of a Technical Practice," 313–43.

23. Bruno Latour, *Pandora's Hope. Essays on the Reality of Sciences Studies* (Cambridge Mass., 1999), 216.

24. For more on this point see Anne-Marie Daune-Richard, "The Social Construction of Skill." in *The Gendering of Inequalities: Women, Men, and Work*, eds. Jane Jenson, Jacqueline Laufer, and Margaret Maruani, (Aldershot, England, 2000), 111–23.

25. For a discussion of the introduction of electricity into the office, see Gardey, "Les femmes, le bureau et l'électricité." *Bulletin de L'association pour L'histoire de L'électricité*, nos. 19–20 (June–December, 1992): 87–98.

26. Advertisement for the Burroughs accounting machine, *Mon Bureau*, 1923; B. Phillip, "Le moteur électrique dans la mécanographie," *Méthodes*, November 1935, 345.

27. An advertisement that appeared in *Mon Bureau*, 1923.

28. For its history, see the case studies edited by Michelle Perrot on women's work and trades, "De la nourrice à l'employée. Travaux de femmes dans la France du XIXe siècle," special issue, *Mouvement Social*, no. 105 (1978); and Perrot, "Métiers de femmes," special issue, *Mouvement Social*, no. 140 (1987).

29. Gardey, "Standardization of a Technical Practice," 313–43.

30. Jean-Maurice Lahy, "Les conditions psycho physiologiques de l'aptitude au travail dactylographique," *Journal de Physiologie et de Pathologie Générale*, 5 July 1913; Lahy, "Les bases scientifiques du travail des dactylographes (1st article); *Mon Bureau*, September 1923, 743–45 (2nd article: 827–32); (3rd article: 935–37); and "Expériences dactylographiques," *Revue du Bureau*, March 1925, 129–36, which is a series of studies previously published by the Académie des Sciences and in the BIT. See also George Ribeill, "Les débuts de l'ergonomie en France à la veille de la Première Guerre Mondiale," *Mouvement Social*, no. 113 (October–December 1980): 3–36; and Gardey, "Standardization of a Technical Practice," 313–43.

31. Cohen and Pestre, eds., "Histoire des techniques," 941.

32. For more on this context, see Gardey, *Un monde en mutation: histoire des employés de bureau en France (1890–1930). Féminisation, mécanisation, rationalisation* (Ph.D. diss., Université de Paris 7, 1995), 823–31.

33. Nicolas Dodier, "Les arènes des habiletés techniques," in "Les objets dans l'action," eds. Bernard Conein et al., *Raisons Pratiques*, no. 4 (1993): 115–39.

34. Gardey, "Standardization of a Technical Practice," 313–43; and Gardey, "Mechanizing Writing and Photographing the Word," 319–52.

35. Of course, removing the study from its context turns it into a purely formal exercise.

36. Jean-Claude Kaufman, *Le coeur à l'ouvrage. Théorie de l'action ménagère* (Paris, 1997).

37. Chabaud-Rychter, "La mise en forme des pratiques domestiques dans le travail de conception d'appareils électroménagers," *Sociétés Contemporaines*, no. 17 (1994): 103–18; and Chabaud-

Rychter, "L'innovation industrielle dans l'électroménager: conception pour l'usage et pour la production," *Recherches Feministes* 9 (1996): 15–36.

38. The history of the construction and use of this instrument deserves more detailed study. See Gardey, *Un monde en mutation: histoire des employés de bureau en France (1890–1930). Féminisation, mécanisation, rationalisation* (Ph.D. diss., Université de Paris 7, 1995), 790–805. For a study from the perspective of the history of accounting practices, see Gardey, "Pour une histoire technique du métier de comptable: évolution des conditions pratiques du travail de comptabilité du début du XIXe siècle à la veille de la Seconde guerre mondiale," *Hommes, Savoirs et Pratiques de la Comptabilité* (Nantes, France, 1997). For a discussion of the calculator market and the use of calculation in Britain, see Andrew Warwick, "The Laboratory of Theory or What Is Exact about Exact Sciences?" in *The Values of Precision*, ed. Norton Wise (Princeton, 1995).

39. For example, see the illustrated advertisements for the Burroughs machine, *Mon Bureau*, 1920, 1923; the Monroe machine, *Mon Bureau*, 1919; and the Rema machine, *Revue du Bureau*, 1924.

40. The market was already very extensive by 1910, with the following machines available in France: the Dactyle, the Walles electric adding machine, the Comptometer, the Millionnaire, the sixty-five models made by Burroughs, the Triumphator, the Brunsviga, the Tim-Unitas, the Eclair, the Dalton, and so forth (*Revue Dactylographique et Mécanique; Mon Bureau*).

41. The advertisement appeared in *Mon Bureau*, April 1911. The illustration is particularly relevant here.

42. In 1920, seven thousand people in the United States were granted diplomas by one of the numerous Comptometer schools that would later develop in Europe (*Mon Bureau*, August 1922, 570). When addressing the office workers who were looking for training and ultimately for work, the manufacturers of the Comptometer used a quite different approach from the one aimed at the bosses: "A course lasting a few weeks at our Comptometer School will transform an inexperienced worker into an expert able to command a high salary." Announcement by Felt and Tarrant, avenue de l'Opéra, Paris, *Revue Du bureau*, April 1921, 155.

43. The *Revue du Bureau* mentions a service like this operating in a department store in 1925. A photograph from 1936 shows a service of women Comptometer calculators from a large Parisian business.

44. For a presentation of the technical details of the different machines, see *Mon Bureau*, November 1913, 695. Robert Des Farges, "Les appareils et les machines de bureau diverses au salon rétrospectif," *Mon Bureau*, June 1930, 243–48; and *Mon Bureau*, November 1930, 485–89. See also Jean Favier and Robert Thomelin, *De la mécanographie à l'informatique* (La Chapelle Montligeon, France, 1972), 35–40; and Jean Marguin, *Histoire des Instruments et Machines à Calculer, Trois Siècles de Mécanique Pensante, 1642–1942* (Paris, 1994).

45. *Mon Bureau*, November 1913, 695. It makes the Comptometer an original alternative, even after calculating machines started to be electrified.

46. The technologies for mechanizing writing that preceded the Sholes Typewriter also comprised a wide range of objects such as cylinders and cursors, Gardey, "Mechanizing Writing and Photographing the Word, 319–52.

47. Chabaud-Rychter, "Innovation industrielle dans l'électroménager," 15–36.

48. Donald Norman, *The Design of Everyday Things* (New York, 1990).

49. For an examination of the nonmechanical techniques and methods used in accounting (mental arithmetic, tables, schedules, etc.) and their persistence as professional practices, see Gardey, "Pour une histoire technique du métier de comptable."

50. On the feminization of accounting professions, see *ibid.*; Sharon H. Strom, *Beyond the Typewriter. Gender, Class, and the Origins of Modern American Office Work (1910–1930)* (Urbana and Chicago, 1992). On the division of accounting work at Renault between the wars, see Gardey, *Un monde en mutation*, 594–96.

51. "Le machinisme dans le bureau," from the *Revue Internationale du Travail* cited in *L'Organisation*, April 1938, 114.

52. For a more in-depth discussion about the social identity of this group of employees, and their ultimate proletarianization, see Gardey, "Du veston au bas de soie: identité et évolution du

Gardey Delphine (2006), « Culture of Gender, Culture of Technology : the Gendering of Things in France's Office Spaces between 1890 and 1930 », in Novotny Helga (ed.), *Cultures of Technology*, Berghahn Books, New York, pp. 73-94.