

Presidential address: Science, industry, and the social order in Mulhouse, 1798–1871

Robert Fox*

THERE is a story, which historians of modern France often tell, of the ministerial official in Paris who had only to glance at his clock in order to know the exact passage of Vergil being construed and the law of physics being expounded in every school throughout the country. Invariably, the story is told for a purpose. It is used to demonstrate the high degree of centralization and the attendant rigidity of the French educational system, usually with special reference to the nineteenth century. The story, which has its roots in the rich corpus of Napoleonic legend, serves this purpose very well, but unfortunately it is both apocryphal and misleading. For while it is true that most nineteenth-century ministers with responsibility for education aspired to the ideal of total control, not one of them came close to it in reality.

This disparity between ideal and reality has become very obvious to me in my own recent research. I am now convinced that provided we move out from Paris and look at France as a whole, then it is diversity rather than uniformity which emerges as the dominant characteristic not only in education but in intellectual life generally. It would be very odd if this were not so. To the eve of the Revolution, the old provinces of France—Picardy, Provence, Normandy, and so on—jealously preserved their various identities. Through their local administrators, they fought vehemently for their diverse economic interests and cultivated distinctive traditions in dress, folklore, and even language. In the nineteenth century, these traditions were still tenacious survivors. Regional patois continued to be used, as they are to this day, and Breton, Provençal, and Flemish were only

* Department of History, University of Lancaster, Lancaster LA1 4YG.

This is a revised version of the Presidential Address delivered at the Annual General Meeting of the *British Society for the History of Science in Manchester* 15 May 1982.

I am grateful to the Royal Society of London for a grant towards the cost of research in France and Britain. I have also drawn on work, financed by the Joint SERC/SSRC Committee, which forms part of a more general study of the relations between scientific education and research and industrial performance in Europe since *c.* 1850.

In preparing the text for publication, I have been greatly helped by my recent appointment to a British Academy Readership in the Humanities and by a discussion of some of the material in the paper at the Parex seminar on 'Science, medicine, and technology in Restoration France, 1814–30', held at the *Maison des Sciences de l'Homme*, Paris, 31 August–2 September 1983.

three of several distinct languages which as late as the 1860s, continued to infuriate Parisian officials intent on demonstrating the oneness of France.¹

I believe that the existence of these deeply ingrained local traditions, in the face of governmental attitudes that were usually hostile and never truly encouraging, is as important for historians of science as it is for other historians of French culture. As I have argued elsewhere, one important focus for cultural provincialism in the nineteenth century was the network of learned academies;² here, nostalgic but by no means incompetent gerontocracies advanced their claims to be regarded as the local arbiters of culture and the champions of economic improvement. Especially after the 1830s, the academies were joined by a flood of less select societies, with interests, notably in antiquities and natural history, that were usually even more parochial. Municipal and departmental authorities also emerged as the patrons of initiatives which served as a bulwark against the take-over of French intellectual life by Paris. As a result, in towns of even modest consequence, learned societies, municipal lecture-courses, museums, and botanical gardens abounded, and, through them, such determinedly provincial *savants* as Boucher de Perthes (in Abbeville), Félix Pouchet (in Rouen), and Henri Lecoq (in Clermont-Ferrand) were able to fashion national reputations.

Of course, my assertion of the neglected vigour of the provincial traditions in nineteenth-century French science is not offered as an argument for disregarding the 'savants officiels' of the great national institutions. But I do believe that a tendency to view French science exclusively through the distorting prism of Paris has left us with an unbalanced secondary literature. Signs that the view from the periphery might at last be attracting more serious attention are, in this respect, encouraging;³ but, for the time being, the way ahead seems to lie in the case-study rather than in synthesis. Hence, despite my programmatic generalizations, I shall devote the rest of my paper to an examination of

¹ François Furet, Jacques Ozouf, et al., *Lire et écrire. L'alphabétisation des Français de Calvin à Jules Ferry* (2 vols., Paris, 1977), vol 2, pp. 324–48, and Eugen Weber, *Peasants into Frenchmen. The modernization of rural France* (London, 1977), pp. 67–94, 310–16, and 498–501.

² Robert Fox, 'The *savant* confronts his peers: scientific societies in France, 1815–1914', in Robert Fox and George Weisz (eds.), *The organization of science and technology in France, 1808–1914* (Cambridge and Paris, 1980), pp. 240–82 (244–58), and 'Learning, politics, and polite culture in provincial France: the *sociétés savantes* in the nineteenth century', *Historical reflections/Réflexions historiques*, 7 (1980), 543–64.

³ See, for example, Terry Shinn, 'The French science faculty system, 1808–1914: institutional change and research potential in mathematics and the physical sciences', *Historical studies in the physical sciences*, 10 (1979), 271–332; Harry W. Paul, 'Apollo courts the Vulcans: the applied science institutes in nineteenth-century French science faculties', in Fox and Weisz, *The organization of science*, op. cit. (note 2), pp. 155–81; Mary Jo Nye, 'The scientific periphery in France: the Faculty of Sciences at Toulouse (1880–1930)', *Minerva*, 13 (1975), 374–403; and George Weisz, 'The French universities and education for the new professions, 1885–1914: an episode in French university reform', *Minerva*, 17 (1979), 98–128, and *The emergence of modern universities in France, 1863–1914* (Princeton, New Jersey, 1983), pp. 134–95.

Illuminating though they are, these studies are all concerned with 'official' science in the provinces, chiefly in the faculties of science. They throw little light on the more indigenous traditions of provincial science.

just one type of science—industrial science—in one Alsatian cotton-town. In doing so, I hope to demonstrate the locally conceived nature of the functions and problems of science in Mulhouse and to justify the misgivings that I feel about the supposed existence of a single entity called ‘French science’.

Culture and Authority in the Traditions of Mulhouse

Mulhouse was one of the wonders of nineteenth-century France.⁴ Its population grew from about 6,000 at the time it became part of France in 1798 to 30,000 in 1848, and finally to almost 60,000 on the eve of the war of 1870, as a result of which it passed, with the rest of Alsace, to the German Empire as part of the annexed eastern territory or *Reichsland* (see Table 2). Expansion on this scale was rivalled only by that of Roubaix, among the major industrial towns. In a mere seven decades, it brought a community which at the beginning of the century had not even appeared among the hundred most populous towns of France to an incomparably more prominent position as the seventeenth town of Napoleon III’s Empire.⁵

The leading industrialists of Mulhouse always insisted that they and their town were truly French. But Alsace, tucked away behind the Vosges and with lines of communication that led more naturally northwards and eastwards than to the west, was always an oddity when viewed from Paris. The language of all but the highest classes was one of the German dialects, and the society was dominated by an economically and politically powerful protestant minority. And if Alsace as a whole seemed odd, often menacingly so, to Parisian administrators, Mulhouse in the southern Alsatian department of the Haut-Rhin seemed odder still and even more suspect. As a local sub-prefect observed ruefully in 1821, the people of Mulhouse were ‘a race apart’—‘apart’ that is, from other Alsations.⁶ And a

⁴ The point is reflected in a vast secondary literature. In this paper, I draw in particular on: *Histoire documentaire de l’industrie de Mulhouse et de ses environs au XIXe siècle (Enquête centennale)* (2 vols., Mulhouse, 1902), and Paul Leuillot, *L’Alsace au début du XIXe siècle. Essais d’histoire politique, économique et religieuse (1815–1830)* (3 vols., Paris, 1959). For a convenient economic history of the region, based on the *Histoire documentaire* and other standard sources, see Henry Laufenburger and Pierre Pflimlin, *Cours d’économie alsacienne* (2 vols., Paris, 1930–2), vol. 2 (‘L’industrie de Mulhouse’). An older but still valuable study cast in Durkheimian terms is Robert Lévy, *Histoire économique de l’industrie cotonnière en Alsace. Étude de sociologie descriptive* (Paris, 1912). Among more recent works, special mention should be made of the essays in Georges Livet and Raymond Oberlé (eds.), *Histoire de Mulhouse des origines à nos jours* (Strasbourg, 1977). Biographical information is readily available in François Édouard Sitzmann, *Dictionnaire de biographie des hommes célèbres de l’Alsace* (2 vols., Rixheim, 1909–10). I have not given references to basic information contained in these volumes.

⁵ On the population of Roubaix, which increased from 8,000 in 1801 to 65,000 in 1866, and of other French towns, see the tables in Paul Meuriot, *Des agglomérations urbaines dans l’Europe contemporaine. Essai sur les causes, les conditions, les conséquences de leur développement* (Paris, 1898), pp. 93–5.

The explosion of the populations of Mulhouse and Roubaix should be contrasted with the more sedate growth of most other textile towns. The population of Rouen, for example, grew by only about 15 per cent between 1801 and 1866 (from 87,000 to 100,000). Even the three-fold increases that occurred in the same period in the populations of Lyon and Lille (from 109,000 to 323,000 and from 54,000 to 154,000 respectively) seem modest by comparison with what occurred in Mulhouse.

⁶ Quoted in Paul Leuillot, ‘Le centenaire de Lambert (1828) dans le Mulhouse en expansion au début du XIXe siècle’, in *Université de Haute-Alsace. Colloque international et interdisciplinaire Jean-Henri Lambert. Mulhouse, 26–30 septembre 1977* (Paris, 1979), pp. 75–93 (78).

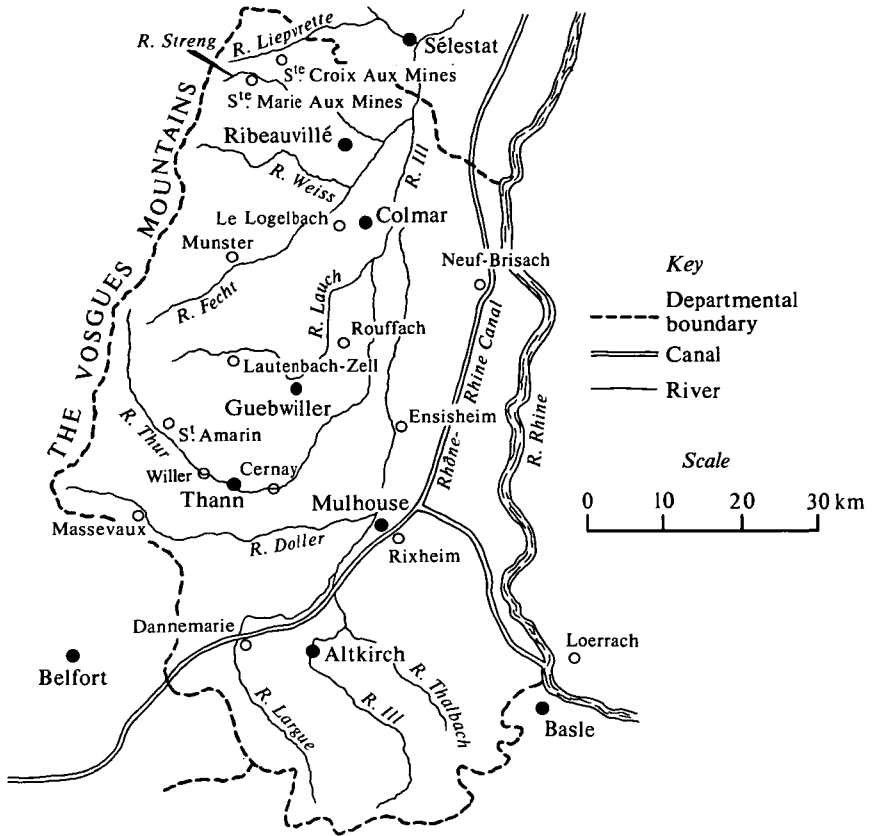


FIGURE 1. Department of the Haut-Rhin

race apart they really were, with a distinctive mentality born of a distinctive history that still weighed heavily on them in the nineteenth century.

From the fifteenth century until 1798, Mulhouse had been a conservative, independent republic, ruled by its closed community of burghers and, since 1524, by the most rigorous Calvinism. From the mid-seventeenth century, the leaders of the republic—the *bourgeois privilégiés*—had assiduously cultivated the French language (at least in public) as a way of demonstrating the superior taste which distanced them from a rustic, not to say uncouth, environment. Yet at the same time as they flaunted their immersion in French culture, they missed no opportunity of fostering other traditions that were quite alien to the France of the Ancien Régime. They preferred to educate their sons not in France but in Calvinist Switzerland—for this purpose, Neuchâtel and Lausanne were particularly

favoured; and it was only at the end of their education that boys might be sent to Montbéliard or some other convenient French town in the vain hope that the last traces of their Alsatian dialect might be eliminated.⁷ Marriage patterns, too, were carefully contrived to reinforce the unswerving Calvinism of the young and their attachment to their region. In this as in all the strategies of the great families of Mulhouse, both during and after the years of independence, the overriding aim of having the best of both worlds was clear. To be French without being wholly French was one of the most potent ways of securing what was, and remained until 1870, their highest priority, to maintain their local power.

During the first half of the nineteenth century, the determination to resist assimilation into the main stream of French life remained as strong as it had ever been. For one young schoolmaster, the future novelist Émile Souvestre, who was sent to Mulhouse fresh from Catholic Brittany in 1836, the shock was profound. The joyless severity of the town, perhaps even the gruff boorishness of the hotel-keepers and Alsatian-speaking tradesmen were to be expected. But the paucity of social and literary refinement was something that Souvestre had not bargained for, as he told a large and eager public in the *Revue de Paris*. His main target, inevitably, was the industrial community, obsessed with work, to the exclusion of all but the most basic human needs:

After a full and busy day in his factories [he wrote] the *industriel* goes home simply to eat and sleep. As a result, his social contacts are limited to his closest relatives, and even at these family gatherings he says little. Tired after the day's work and anxious about the day ahead, he is usually content to do no more than digest in society.⁸

Even the rising generations offered no hope of improvement. At the age of five, according to Souvestre, a child would know the price of coal; at eight, he would understand the principles of the steam engine; by fifteen he was a foreman.⁹

For his unflattering portrait of Mulhouse, Souvestre suffered a predictable fate. Public ridicule was intolerable, and his victims duly intervened with the Minister of Public Instruction to secure his dismissal.¹⁰ Souvestre's crime, of course, was to have perceived and published the truth. His description of the tasteless profusion of possessions in the homes of the industrial élite, of the preoccupation with comfort at the expense of elegance, and of the obsessive industriousness that left the owner of a factory with less leisure than his humblest employee, was only too accurate.

⁷ Paul Mieg, 'La langue et la culture française à Mulhouse jusqu'à la fin du XVIIIe siècle', in *Les lettres en Alsace* [Publications de la Société Savante d'Alsace et des Régions de l'Est, no. 8] (Strasbourg, 1962), pp. 179–92.

⁸ Émile Souvestre, 'Mulhouse', *Revue de Paris*, new ser. 31 (1836), 145–53 (147).

⁹ *Ibid.*, p. 148.

¹⁰ It seems virtually certain that some kind of intervention occurred, though the published information on Souvestre's rapid departure from his post at the *collège communal* is limited to a note in the *Histoire documentaire de l'industrie de Mulhouse*, op. cit. (note 4), vol. 1, p. 84.

It is inconceivable that Souvestre overlooked the doctrinal foundations for the attitudes he described, though he kept his comments on the Calvinism of the industrial families quite separate from his general disparagement of their customs and values. In reality, such a separation never existed. In all aspects of their lives, the *industriels* of Mulhouse made a quite deliberate display of their religiously inspired austerity. Calvinism and earnestness were both very much part of the public man, and they were duly invoked, in generation after generation, as the hallmarks of superiority. Obituaries throughout the nineteenth century made it plain that the success of the industrial clans owed everything to their simplicity, their dedication to work, and, above all, the manifest piety which they displayed not only in formal religious observances but also in compassionate acts of charity. These were the qualities which justified wealth and authority and which made the *industriels* fit objects for emulation. A comparison of the eulogies of Henri Schlumberger, Nicolas Koechlin, and Jean Zuber *père*, all of whom died in 1852, makes the point very plainly.¹¹ In all three cases, a story of early struggle, resilience in the face of personal tragedy, generosity to family and employees alike, and lightly borne distinction was united with references to providence which implied unmistakably that here, in a remote corner of Alsace, something resembling a divine plan was being unfolded.

In suggesting that the maintenance of local power was the highest priority of the Mulhousien élite, I am making a deliberately undifferentiated statement. For while the character and objectives of the élite remained the same in the two hundred years or so up to 1871 the means of power varied greatly. Until the mid-eighteenth century, the means had been straightforwardly political: a few families—those of Dollfus, Koechlin, and Hofer, in particular—had hogged the main offices of the republic, including the all-important position of burgomaster, and steered the republic's Grand Council in whatever direction best served their interests. But from 1746, when the first calico-printing works were established in Mulhouse, the context for the exercise of power began to change, albeit with no significant shift in the *location* of power. All that happened in the later eighteenth century was that the political ascendancy of the ruling families came to be buttressed by economic success in the expanding world of manufacturing. The involvement of Samuel Koechlin (the son-in-law of one of the most distinguished eighteenth-century burgomasters, Jean Hofer) and of Jean-Henri Dollfus (who later became burgomaster himself) in the first calico-printing venture is entirely typical of the way in which the arrival of industry reinforced, rather than weakened, the established oligarchy.¹²

¹¹ The eulogies, all delivered to the Société Industrielle de Mulhouse, are published in *Bulletin de la Société Industrielle de Mulhouse*, 24 (1852) 115–29 (Auguste Scheurer-Rott on Schlumberger), 193–217 (Achille Penot on Koechlin), and 269–81 (Jean Weber on Zuber).

¹² The establishment of Koechlin, Schmaltzer et Cie in 1746 marks the beginning of the history of

From the start, the Mulhouse cotton industry became predominantly the affair of the three families of Dollfus, Koechlin, and Hofer. And it long remained so, though the Hofers eventually became less prominent, and at the same time a small circle of satellite families—those of Schlumberger, Heilmann, Thierry, Mieg, Zuber, Schwartz, and Engel, in particular—was cautiously absorbed. Capital flowed between these families as freely as public offices had done for generations past; inter-marriage was practised as frequently as decency would allow; and industrial expansion was made possible (and in some degrees made necessary) by a succession of huge progenies (see Figures 2 and 3). Samuel Koechlin began the tradition by producing seventeen children. Two of them, in turn, had fourteen children each, while another son (Jean Koechlin, the greatest of the early calico-printers) married a Dollfus and had twenty. Of these twenty children, all eleven of the boys who survived to adulthood entered the textile industry, and all the girls married textile industrialists and bred more of them the same.¹³ The Koechlins, in particular, were so relentlessly prolific that in 1881, a hundred years after the death of Samuel Koechlin, it was estimated that he had more than 2,250 living descendants.¹⁴

In the last four decades of the Ancien Régime, the carefully managed strategy of family control and prudent investment allowed the new textile industrialists of Mulhouse to refashion the economy not only of the republic itself (the area of which was no more than eight square miles) but also of a wider region, in French territory, extending eastwards to the Rhine, westwards to the precipitous valleys of the Vosges, and northwards in the direction of Colmar, twenty-five miles away.¹⁵ In Mulhouse alone, the number of establishments engaged in calico-printing had grown to fifteen by 1768, and hand-weaving (at this time almost entirely of imported

Mulhouse as a significant industrial town. Two of the partners—Jean-Jacques Schmalzter and Koechlin—had had industrial or commercial experience; the role of Dollfus was chiefly as a designer.

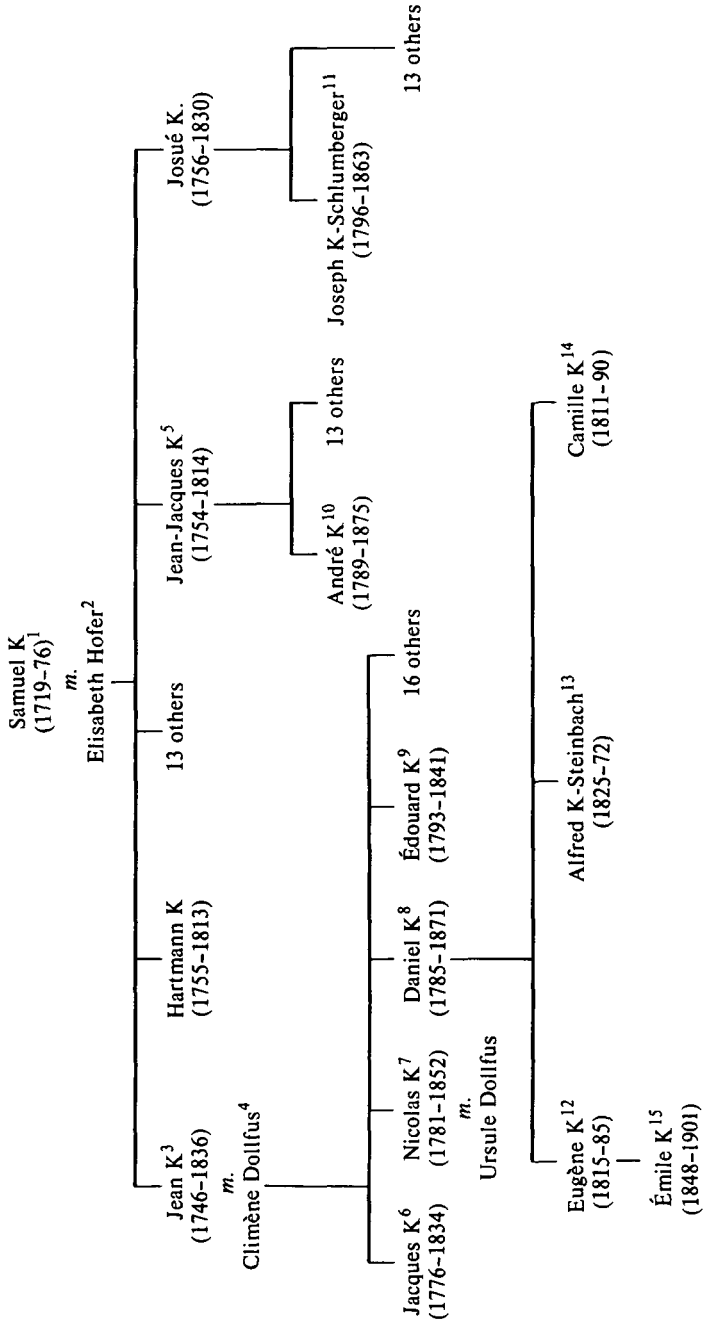
¹³ See the list of children and their occupations and marriages in André Brandt, 'Une famille de fabricants mulhousiens au début du XIX^e siècle. Jean Koechlin et ses fils', *Annales ESC*, 6 (1951), 319–30 (321n).

¹⁴ Auguste Dollfus, 'La famille Koechlin', *Bulletin du Musée Historique de Mulhouse*, 6 (1881), 108–10 (108).

¹⁵ The industrial communities beyond the boundaries of the republic were established to help in the securing of markets in France and to avoid customs duties and some restrictive legislation within the republic. Achille Penot explains this legislation as an attempt to protect the older, small-scale manufacturers of woollen cloth and the associated traders; see *Histoire documentaire de l'industrie de Mulhouse*, op. cit. (note 4), vol. 1, p. 298, and cf. the similar analysis given in Xavier Mossman, *Les grands industriels de Mulhouse* (Paris, 1879), pp. 8–9 and 17–18. However, it seems necessary to draw a distinction between the obstructiveness often displayed by the six 'tribes', or trade corporations, into which the population of Mulhouse was divided, and the attitudes of the civic leaders of the republic, most of whom were cautiously favourable to the new industry of calico-printing; see Frédéric Engel-Dollfus, 'Rapport sur un mémoire traitant de l'industrie du coton du Haut-Rhin', *Bulletin de la Société Industrielle de Mulhouse*, 32 (1862), 527–33 (530), and Laufenburger and Pfimlin, *Cours d'économie alsacienne*, op. cit. (note 4), vol. 2, pp. 185–216.

It should be noted that Mulhousien influence never embraced Colmar. The difference between the economic and social development of the two towns is marked. The greater openness of Colmar to outside influences is suggested by the fact that the only Catholic textile manufacturers in southern Alsace, Antoine Herzog (father and son), were established just outside the town, at le Logelbach, from 1818 to 1870.

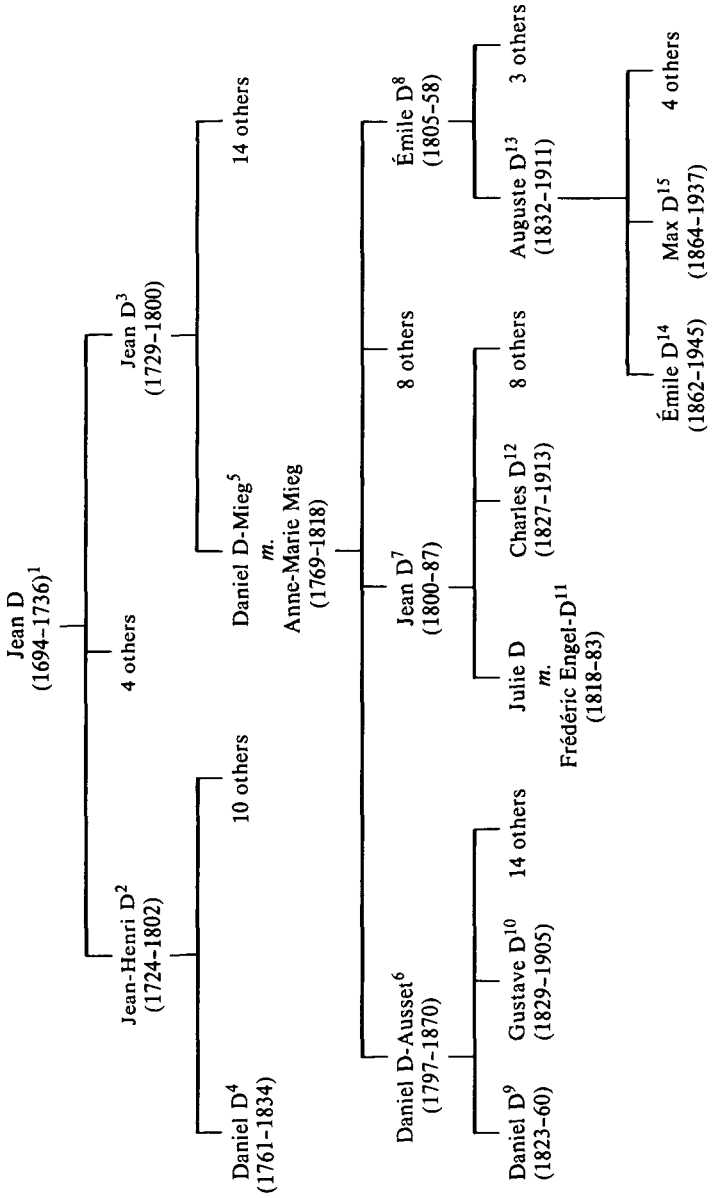
FIGURE 2. The Koechlin family



Notes to Figure 2

- ¹ Descendant of Hartmann Koechlin of Zurich, who came to Mulhouse in 1596.
- ² Daughter of Jean Hofer, burgomaster of Mulhouse (1748–81).
- ³ Established, with his brothers Josué and Hartmann, Koechlin frères, calico-printers, in 1777. Later associated with Nicolas Koechlin et frères.
- ⁴ Sister of Daniel Dollfus-Mieg (1769–1818) and daughter of Jean Dollfus (1729–1800); see Figure 3.
- ⁵ Doctor.
- ⁶ Mayor of Mulhouse (1819–21) and deputy for the Haut-Rhin. Financed early railway building in Alsace.
- ⁸ Studied chemistry in Paris with Fourcroy and Vauquelin. Head of Frères Koechlin.
- ⁹ Associated with Nicolas Koechlin (6) in development of railways in Alsace.
- ¹⁰ Mayor of Mulhouse (1832–43). Secured by marriage a major interest in Dollfus-Mieg et Cie. Locomotive builder. Deputy for the Haut-Rhin (1832–48).
- ¹¹ Spinner and calico-printer. Mayor of Mulhouse (1852–63). Geologist in later life.
- ¹² Succeeded his father as head of Frères Koechlin.
- ¹³ Leading figure in republican opposition to the Second Empire.
- ¹⁴ Eminent colourist.
- ¹⁵ Succeeded his father at the head of Frères Koechlin.

FIGURE 3. The Dollfus family



Notes to Figure 3

- ¹ Merchant.
- ² Designer and partner in Koechlin, Schmalzter et Cie (1746).
- ³ Calico-printer. Grandson of the mathematician Jean Bernoulli. One of the three last burgomasters of Mulhouse.
- ⁴ Calico-printer. Son-in-law of Jean-Michel Haussmann.
- ⁵ Founder of Dollfus-Mieg et Cie (1800).
- ⁶ Chemist, geologist, alpinist. Technical director of Dollfus-Mieg et Cie.
- ⁷ Calico-printer. Senior partner in Dollfus-Mieg et Cie. Mayor of Mulhouse (1863–9). Deputy to the Reichstag (1877–87). Promoter of the Cités ouvrières from 1853.
- ⁸ Partner in Dollfus-Mieg et Cie. President (1834–58) and benefactor of Société Industrielle. Mayor of Mulhouse (1843–9). Deputy and active in national politics (1846–52).
- ⁹ Partner in Dollfus-Mieg et Cie. President of the Société Industrielle (1858–60). Collector and connoisseur.
- ¹⁰ Graduate of École Centrale des Arts et Manufactures. Active in Dollfus-Mieg et Cie. Agriculturalist.
- ¹¹ Partner in Dollfus-Mieg et Cie. Supporter of Jean Dollfus (7). in campaign for free trade in 1860s.
- ¹² Writer and journalist.
- ¹³ Textile manufacturer. Member of Town Council of Mulhouse (1865–1902). President of Société Industrielle (1864–1911).
- ¹⁴ Chairman of the Board of the Société Alsacienne de Constructions Mécaniques. President of the Société Industrielle.
- ¹⁵ Historian of the Dollfus family.

cotton thread) had begun to be organized on a factory basis. An unusually favourable system of tariffs and the accessibility of markets in Germany, Italy, Holland, and, above all, France meant that profits came easily. It is true that by the 1770s and 1780s there were some signs of competition: the most notable challenge came from Jouy, near Versailles, where Christoff-Philipp Oberkampf was beginning to exploit the removal of the ban which had prevented the production of printed cottons (*toiles peintes*) in France from 1686 to 1759.¹⁶ But on the eve of the Revolution, even Jouy presented no serious threat to Mulhouse, at least in fashion fabrics, the *indiennes fines*,¹⁷ for which original designs and colours (already emerging as the main Mulhousien specialities) were all-important.

Although the events of 1789 had few political repercussions in Mulhouse, the increasingly hostile tariff policies of successive French governments and the revolutionary wars that began in 1792 eventually took their toll on trade. In particular, unfavourable duties and disruption virtually deprived the republic of its most lucrative market, in the Midi. And so what had been highly propitious geographical and political circumstances now became so great a handicap that in 1798 there was no realistic alternative but to accept integration with France. On 15 March, the keys, flag, and other trappings of Mulhousien independence were buried with great ceremony and a tree of liberty symbolizing the nascent union of the two republics was planted. There were those—some members of the Hofer family and other so-called *aristocrates*—who opposed the union and derived a perverse satisfaction from seeing the tree quickly die.¹⁸ But in the debate preceding the union, the rival party of *patriotes*, led by the formidable clan of Koechlin, held and played very effectively the powerful trump card of commercial necessity. The vote of 97 to 5 taken by part of the Grand Council and the republic's forty elders is an indication of the dominant position which the industrial interest had come to occupy by 1798.

¹⁶ On Oberkampf, whose factory at Jouy began operating in 1760, see Serge Chassagne, *Oberkampf. Un entrepreneur capitaliste au siècle des lumières* (Paris, 1980), and, for a briefer treatment in English, S. D. Chapman and Serge Chassagne, *European textile printers in the eighteenth century. A study of Peel and Oberkampf* (London, 1981).

¹⁷ *Indiennes*, or *indiennes*, was originally the name given to the printed cotton fabrics which had been produced in India since ancient times. But it was quickly applied to the similar, though invariably coarser, products which began to be manufactured in Europe from the seventeenth century.

¹⁸ In most of the standard histories, the conflict between the *aristocrates* (led by Josué Hofer) and the *patriotes* (led by the families of Koechlin and Thierry) is played down. But see Max Dollfus, *Histoire et généalogie de la famille Dollfus de Mulhouse 1450-1908* (Mulhouse, 1909), pp. 9-10, on what was in reality a bitter confrontation. The Hofer and Dollfus families were both split on the issue, and while the members of those families which had strong industrial interests never doubted that the union was necessary, laments about the passing of the old order continued to be voiced until well into the nineteenth century. The most vociferous of those who deplored the disruptive effect of industry was Mathieu Mieg ('the chronicler'). His coolness towards the industrialists is very plain in his main historical works: *Der Stadt Mülhausen Geschichte bis zum Jahr 1816 [1817]* (2 vols., Mulhouse, 1816-17) and *Relation historique des progrès de l'industrie commerciale à Mulhausen et ses environs* (Mulhouse, 1823).

The Strategies of Industrial Success, 1798–1830

Despite the triumph of the *patriotes*, it was only eight years later, with the establishment of the Continental System, that the advantages of the union began to be fully realized. Then, in the absence of English competition, the cotton fabrics of Mulhouse penetrated the eastern parts of the French Empire with ease. Prices for *indiennes* were high, and substantial profits earned in virtually captive markets provided a steady flow of capital for investment on a scale that gives the lie to any notion of French industrial stagnation during the Napoleonic wars. Some of the capital was used simply to expand existing activities in dyeing, calico-printing, and (a relative newcomer) wallpaper manufacture. But most of it seems to have been directed to financing a totally new departure into spinning, with the aim of achieving self-sufficiency at a time when spun cotton from traditional sources abroad was either unavailable or, because of heavy duties and transport costs, prohibitively expensive.

The mixture of growth and restructuring had impressive consequences. By 1812, only ten years after the opening of the first spinning mill at Wesserling, there were eleven such mills in the Mulhouse area. With the mills, which marked the beginning of advanced manufacturing technology in the region, there emerged a new breed of owner-managers provided by the rising generations of the great families. In view of the undiminished resolve of these families to protect their economic interests and to resist any dilution of their power, it was no coincidence, but rather the start of a regular pattern of development, that Nicolas Koechlin (at Massevaux) and Nicolas Schlumberger (at Guebwiller) established themselves in these years as two of the region's leading cotton-spinners, even though both men were still in their twenties.

Between 1806 and 1814, the cotton industry of Mulhouse assumed a character for which the desire to maintain an existing social structure, the protectionism of the Continental System, and a location in on the rather thinly populated periphery of France all had their share of responsibility. So long as Mulhouse maintained its reputation for quality and sensitivity to fashion (responding, for example, to the vogue for light, coloured 'shawls' after the Egyptian campaign), the pickings were easy. In certain respects, they may even have been too easy, for profits were high, even with a relatively low level of production, and, as a result, mechanization and the reduction of manufacturing costs became secondary objectives. The priorities in technology lay unmistakably in the field of high-quality colour printing. Hence at a time when machinery remained (by English standards) primitive, new techniques for the preparation and application of dyestuffs were developed in ways that even the specialist dyers of Accrington would have found impressive. Using methods which had distant roots in England and Augsburg, where he had worked as a chemist

in J. H. de Schulé's calico-printing works in the 1760s and 1770s, Jean-Michel Haussmann fostered a particularly distinguished tradition of research and development at his own works at le Logelbach near Colmar; his successes, ranging from improved methods for the fixing of well-known dyes such as Prussian blue and the brilliant *rouge d'Andrinople* to the introduction of organic mordants, were outstanding, but they provoked emulation in most of the calico-printing enterprises of the area.

The history of research and development in the technology of dyestuffs and their application in this period can only strengthen the view that the gap between British and French technology under the Empire is due for reassessment. Perhaps, in Britain at least, we have been too swayed by the disparaging tone of most British accounts of French industry after 1814 and by some calculated scaremongering on the part of Charles Dupin and other French visitors who came to England in the early years of the Bourbon Restoration.¹⁹ My own preference, in fact, is for an analysis of British and French technical achievements that would dwell on clear distinctions between different technologies and between different regions of France, rather than on the well-worn track of a supposed British superiority across the board. In this respect, I am inclined to follow the lead taken in the Comte de Chaptal's justly unapologetic account in his *De l'industrie française* (1819).²⁰ The evidence of Mulhouse would certainly endorse Chaptal's assessment of France's high standing in the 'chemical arts',²¹ as it also supports the very important recurring theme of Graham Smith's study of the heavy chemical industry in the regions of Paris, Marseille, and Rouen.²² Clearly, as Smith shows, in the revolutionary and Napoleonic periods, France had areas of real technical superiority.

Still, the traditional point about the backwardness of Mulhouse in mechanization and power technology remains. The correspondence of Oberkampf's nephew, Samuel Widmer, who visited several factories in southern Alsace in 1809, suggests that machinery in the region was more primitive and less well used than in Jouy.²³ Roman's spinning mill at Wesserling was likened to a dirty stable; printing with copper rollers was rarely practised, and only then very inefficiently; and even at Dollfus-Mieg et Cie, always regarded as a technological pacemaker in Mulhouse,

¹⁹ See, in particular, F. P. Charles Dupin, *Voyages dans la Grande-Bretagne, entrepris . . . en 1816, 1817, 1818, 1819, et 1820* (6 vols., Paris, 1820-4).

²⁰ J. A. Chaptal, *De l'industrie française* (2 vols., Paris, 1819).

²¹ In his 'Discours préliminaire', Chaptal wrote, with only slight exaggeration, that by 1819 France had established herself 'in the first rank of manufacturing nations' and that she was 'unrivalled in the chemical arts'. See Chaptal, *De l'industrie française*, op. cit. (note 20), vol. 1, p. xlv.

²² John Graham Smith, *The origins and early development of the heavy chemical industry in France* (Oxford, 1979), especially p. 312. Smith's book is a notable exception to the point I make at the end of note 3, above. The local context of the industrial science he describes is treated in great detail.

²³ The relevant correspondence is quoted in Chassagne, *Oberkampf*, op. cit. (note 16), pp. 218-19, and less extensively in Chapman and Chassagne, *European textile printers*, op. cit. (note 16), pp. 142-3. For a full transcription, see also 'Lettres écrites d'Alsace par S. Widmer (1788-1809)', *Bulletin du Musée Historique de Mulhouse*, 34 (1910), 105-17 (107-17).

Widmer 'did not see anything special'. The contrast would have been even more striking if the comparison had been made with Lancashire rather than Jouy, as witnesses at the time of the renewal of contract with Britain in 1814 make abundantly clear. Britain's undoubted lead in mechanization provides the starting-point for Charles Ballot's classic study, *L'introduction du machinisme dans l'industrie française* (1923), and it is referred to time and again in the evidence given in 1824 in London before the House of Commons Select Committee on Artisans and Machinery. According to the much-quoted testimony of Adam Young, a Manchester carder who worked for Nicolas Schlumberger at Guebwiller from 1818 to 1820, the Alsatians were at least twenty years behind the British in their technology for the spinning of fine thread.²⁴ His point is supported by the fact that, at the time when Young was there, Schlumberger employed six skilled operatives from England. Clearly, English carders, spindle-makers, spinners, and stretchers were prized, despite their reputation for intemperance and their unreasonableness as employees, and they were paid accordingly. Young's wage was 12 francs (about ten shillings) a day, roughly six times the amount paid to the Alsatians who worked under him.

Yet even this telling and seemingly reliable evidence has to be read with caution. Three qualifications are necessary. First, the total number of British workmen in Alsace was not large.²⁵ The six who were employed at Guebwiller were part of a workforce of over 600, and it has been estimated that between 1814 and 1830 no more than a hundred English immigrants ever worked in Alsace.²⁶ Moreover, the great majority of them stayed for only a year or two and then returned to Britain, probably for reasons similar to those which brought Young back to Manchester: 'I did not like the diet, nor the people, nor anything they had' was his comment.²⁷ Secondly, the very selective nature of the integration of immigrants in the textile industry is plain. The demand in Alsace was for a small range of

²⁴ Young's evidence appears in the *Fifth report from Select Committee on Artizans and Machinery*, Parliamentary Papers (hereafter P.P.) 1824, vol. 5, pp. 579–82.

²⁵ It was certainly far smaller than the number engaged in the region of Paris, chiefly by manufacturers of steam-engines and other industrial machinery. At Humphrey Edwards's Chaillot works, for example, 500 English workmen were said to be employed in 1824; see John Martineau's evidence in *First report from Select Committee on Artizans and Machinery*, P.P. 1824, vol. 5, p. 9. Cf. also the figures of 200 and 300 English workmen said to be employed at the iron works of Manby and Wilson at Charenton; it seems that all positions at Charenton, except those of unskilled labourers, were filled by Englishmen. The figure of 200 is given by William Turner, a steam-engine fitter, in *Second Report from Select Committee on Artizans and Machinery*, P.P. 1824, vol. 5, p. 110; the figure of 300 is Alexander Galloway's, given in *Report from the Select Committee on the Laws relating to the Export of Tools and Machinery*, P.P. 1825, vol. 5, p. 43. According to Galloway, between 15,000 and 20,000 British artisans were employed in what he described as 'the French Empire'. Roughly a tenth of this number were employed in the manufacture of iron; about 1,000 of the workmen were in Paris.

²⁶ André Brandt, 'Travailleurs anglais dans le Haut-Rhin dans la première moitié du XIXe siècle', in *Actes du 92^e Congrès National des Sociétés Savantes. Strasbourg et Colmar 1967. Section d'Histoire Moderne et Contemporaine* (2 vols., Paris, 1970), vol. 2, pp. 297–312 (300).

²⁷ Cf. the equally disenchanting comment of James Lever, formerly a textile worker in Saint-Quentin, who complained, on his return to England, that he could not live as comfortably in France as he could in Manchester and that he could obtain 'no good ale' and only inferior beef and mutton. Laver's evidence is in *Fifth report*, op. cit. (note 24), pp. 336–7.

highly specialized skills, like Young's, that were relevant to the spinning of fine yarns (an activity which Nicolas Schlumberger brought to Alsace in 1819) and to the construction and maintenance of the appropriate machinery. Thirdly, it is clear that as local workmen learned their skills, the senior British operative became a rarity. Paradoxically, the repeal of the British restrictions on the emigration of labour in 1825 only hastened the process, since it allowed workmen to return to Britain without fear of a penalty, and many of them who were in France at the time seized the opportunity.

The determination that textile production should draw selectively on British expertise and then move resolutely towards autonomy guided industrial policy in southern Alsace throughout the Restoration. Yet autonomy was never seen as synonymous with isolation. Even at the height of the war with Britain, Nicolas Koechlin and Nicolas Schlumberger had visited Manchester,²⁸ and after 1814 such exchanges (now in both directions) became common, with obvious advantages for the transfer of technical information. For the Mulhousien visitors to north-west England, it was, predictably, the mechanization of the British textile industry which was most striking, especially in the early years of the century. In 1814, the gap between a region that introduced its first steam-engine (a ten-horse power engine of Parisian origin but unknown design used to drive spinning machinery at Dollfus-Mieg et Cie²⁹) only two years earlier, and Manchester, with its scores of engines, was glaring. But over the next fifteen years, even that gap narrowed, at least in terms of the quality and modernity, if not the number, of the machines in use in Alsace. The narrowing owed something to the (largely clandestine) importation of machinery from England: four steam-engines from Manchester were said to be in use in the Haut-Rhin in 1826, for example. But it owed more, especially in the later years of the Restoration, to the growth of an indigenous machine construction industry in and around Mulhouse. The success of that industry is reflected in improvements that affected both productivity and quality. Whereas in 1816–17 a mule with 240 spindles would spin 3 kg of

²⁸ Nicolas Schlumberger's contacts with Manchester were particularly close. He worked in England for over three years between 1802 and 1805, corresponded with Benjamin Kennedy and William Fairbairn, and seems, after the Empire, to have been very effective in persuading British workmen to emigrate to Alsace (see below, note 31, for example). On the ease of contacts between the Haut-Rhin and south Lancashire in the early decades of the nineteenth century, see André Brandt, 'Apports anglais à l'industrialisation de l'Alsace au début du XIXe siècle', *Bulletin de la Société Industrielle de Mulhouse*, no. 1 (1967), 27–41, and 'Travailleurs anglais dans le Haut-Rhin', op. cit. (note 26).

²⁹ The engine, which was probably of the kind designed by Watt in the 1780s, was constructed by Salneuve in Paris and used to drive spinning machinery. See 'Résumé des notes laissées par M. Hartmann-Liebach sur l'histoire industrielle du Haut-Rhin, depuis les premières années du XIXe siècle', *Bulletin de la Société Industrielle de Mulhouse*, 47 (1877), 218–35.

The extent of Mulhousien backwardness in power technology is also conveyed by Émile Dollfus's observation that water power only began to replace horses and manual labour for the driving of machinery in 1809–10. See Dollfus, 'Notes pour servir à l'histoire de l'industrie cotonnière dans les départements de l'Est', *Bulletin de la Société Industrielle de Mulhouse*, 27 (1855–7), 435–61.

cotton in one day, between 8 and 9 kg would be spun (to a higher standard) on a machine of comparable size in 1831.³⁰

The changing nature of the relations between Alsace and Britain in the field of machine construction is illustrated clearly by a case-history that begins with an obscure foundryman and engineer by the name of Job Dixon. It was Dixon, coming penniless from Manchester to Cernay in 1820, who provided the technical skills for the firm of Risler frères et Dixon, where mechanical engineering in southern Alsace effectively began.³¹ Until its bankruptcy amid the economic crisis of 1827, Risler frères et Dixon supplied the region with machinery of the latest design for spinning and weaving, and served as a training-ground for a new generation of Alsatian engineers, including Émile Koechlin, a nephew of one of the senior partners, Jérémie Risler. Another, even more important route by which English influence stimulated engineering in Alsace was through the association of André Koechlin et Cie with the Manchester engineers, Sharp, Roberts, and Co. Between 1826, when the association began, and 1828, Richard Roberts made three visits to Mulhouse and, in return, received Alsatian engineers at his works in Manchester.³² As in the case of Dixon's activity at Cernay, the Alsatian partners in the relationship learned quickly. An initial arrangement whereby André Koechlin et Cie constructed textile machinery under licence, using designs supplied by Sharp, Roberts, and Co., soon evolved into one of far greater, though never total independence. It is a mark of the incompleteness of Alsatian emulation and of the smaller size of the industry in Alsace that when new technologies and construction on a much larger scale were called for—at the time of the building of the railway lines from Mulhouse to Thann (1839) and between Strasbourg and Bâle (1841)—Sharp, Roberts, and Co. were called upon once again, with the Koechlin company assuming, at first, a secondary role.³³

However, in the Restoration as in the Empire, dyeing remained one technology in which Mulhouse was unquestionably the pacemaker and in which self-sufficiency was a reality. As early as 1815, the Lancashire calico-printer James Thomson had reversed the more familiar direction of technological indebtedness by securing the exclusive right to import and sell in Britain certain of the finer printed cottons (in particular the

³⁰ Achille Penot, *Statistique générale du département du Haut-Rhin* (Mulhouse, 1831), pp. 322–3.

³¹ Brandt, 'Apports anglais', op. cit. (note 28), pp. 30–1. According to Leuillot, *L'Alsace au début du XIXe siècle*, op. cit. (note 4), vol. 2, p. 347, Dixon was recruited in the first place by Nicolas Schlumberger. Risler frères had been established as recently as 1818. They were the first machine-builders of any consequence in the region.

³² Brandt, 'Apports anglais', op. cit. (note 28), pp. 32–3. For a list of fourteen British engineers engaged by André Koechlin et Cie in 1827, see Brandt, 'Travailleurs anglais dans le Haut-Rhin', op. cit. (note 26), pp. 308–9.

³³ Brandt, 'Apports anglais', op. cit. (note 28), p. 33. Nicolas Koechlin, who was chiefly responsible for the construction of the railway system in southern Alsace, ordered the first three locomotives for the new lines from Sharp, Roberts, and Co. Thereafter, most locomotives were constructed by engineers in Mulhouse, who used the imported locomotives as their prototypes.

celebrated *rouges turcs*) of Nicolas Koechlin et frères.³⁴ Twenty years later, despite being more costly than comparable British products,³⁵ Alsatian fashion fabrics were still sought after. They were of outstanding design, and, above all, benefited from a technical expertise developed by a new and very distinctive industrial profession, that of the textile chemist or colourist. Whereas Haussmann, Nicolas Koechlin, and the other calico-printers of the early years of the century had regarded dyeing as just one of a range of skills which they had to master, by the 1820s calico-printers were more likely either to specialize in dyeing themselves or to employ one of their younger relatives for the purpose. The careers of two of the most distinguished colourists of the Restoration and July Monarchy—Daniel Koechlin-Schouch and Henri Schlumberger—show how international reputations could be won in either way. Koechlin-Schouch was a calico-printer who devoted himself increasingly, in his later career, to dyestuffs and their application; his pupil, Henri Schlumberger, was typical of a slightly later generation in that he began his career as an apprentice colourist, entering the firm of Nicolas Koechlin et frères in 1818 at the age of fifteen and rising eventually to the top of his profession as chief chemist at Dollfus-Mieg et Cie.³⁶

It is not hard to unravel the economic and social priorities that gave industrial development in southern Alsace its distinctive character. Poor communications and the high price of coal and raw materials (on both of which counts Normandy had a marked advantage) made it natural to concentrate on quality and design rather than on mass production. An important influence was also exerted by the undiminished sense of separateness in religion and culture and by the perennial problem of finding suitable local employment for the younger members of the great families. The practice of recruiting the main colourists from these families undoubtedly contributed to the high status and salaries associated with the profession as it existed in Mulhouse.³⁷ Likewise, family bonds guided the pattern of diversification from calico-printing into spinning, weaving, wallpaper manufacture, and machine construction, and the trend by which these activities became the responsibility of separate firms with

³⁴ Daniel Koechlin-Schouch, 'Notice nécrologique sur M. James Thomson', *Bulletin de la Société Industrielle de Mulhouse*, 23 (1850–1), 182–5.

³⁵ At the Frankfurt fair of 1818, for example, Mulhousien printed cottons were 40 per cent dearer than their British rivals, yet they were preferred by buyers because of their superior design; see Leuillot, *L'Alsace au début du XIXe siècle*, op. cit. (note 4), p. 389. Over the next half century, the preference was not sustained, as I point out in note 102, below.

³⁶ See the obituary cited in note 11, above.

³⁷ At Dollfus-Mieg et Cie, for example, *coloristes* would commonly receive an annual salary of 12,000 francs (about £500). This should be compared with the salaries of professors in the provincial faculties of science, which seldom exceeded 5,000 francs. Even at the end of a long and distinguished academic career (spent almost entirely in Mulhouse as a close associate of the great industrial families), the chemist Achille Penot earned less than 6,000 francs p.a. in the early 1860s; see his personal file in Archives Nationales, F¹⁷ 21456. It is also instructive to compare the salary of £400, rising to £600, that was offered to Lyon Playfair when he accepted his appointment as 'chemical manager' with James Thomson at Clitheroe in 1841; see T. Wemyss Reid, *Memoirs and correspondence of Lyon Playfair* (London, 1899), p. 44. Such a salary was quite exceptional in England at the time.

personal ties to a larger parent company.³⁸ As a result, the industrial structure of southern Alsace changed but it did so in a manner which left economic power in precisely the hands which had always wielded it.

Of the numerous institutions and activities through which this strategy of meticulously controlled expansion was pursued, the most significant was the Société Industrielle de Mulhouse.³⁹ From its foundation in 1826 until the annexation in 1871, the society served as a mouthpiece for the expanding industrial élite and as a way of profitably engaging its intellectual energies, especially those of its younger members. The society's declared objectives were predictable enough: to provide a scientific basis for industrial practice, to encourage the spirit of enterprise, and to advance public welfare. In all these respects, it was successful. Specialized committees on chemistry and machinery, substantial prizes for technical improvements, and a heavily subsidized *Bulletin* fostered discussion and the dissemination of industrial research that transcended such frail boundaries as existed between individual firms; a very effective system of *plis cachetés* encouraged the protected inventions and innovation; and, especially from the mid-century, the committee on 'économie sociale' developed an important role in the promotion of philanthropy and education.

Although the enthusiasm for the economic activities and good works was no empty charade, it cannot be understood in isolation from the unspoken motives and hidden bonds that also fired Mulhousien paternalism. Thirteen of the twenty-two founder-members of the society bore the names of Koechlin, Dollfus, Schlumberger, Thierry, or Heilmann, or combinations resulting from inter-marriage. And twelve of the twenty-two belonged to the masonic lodge, La Parfaite Harmonie, whose activities had assumed a new vigour since 1824, when its head, Jacques Koechlin, had returned as a liberal hero from a much-publicized sentence in the Sainte-Pélagie prison.⁴⁰ The particular brand of Freemasonry that

³⁸ These two tendencies are evident in the history of Nicolas Koechlin et frères between 1802 and 1836. The firm began in 1802 when, at the age of twenty, Nicolas Koechlin set up as a spinner at Massevaux. A quarter of a century later, at the peak of their prosperity, Nicolas Koechlin et frères were engaged in calico-printing and spinning in Mulhouse; spinning, weaving and bleaching at Massevaux; and calico-printing and weaving at Loerrach. By then, there were, in all, 5,000 employees. When the firm was wound up in 1836, the various activities continued to be pursued, but under a number of separate firms. By the 1830s, the huge firm of Dollfus-Mieg was unusual in maintaining strong interests in all three main branches of the textile industry: spinning, weaving and calico-printing. On the trend, which tended inevitably to undermine the community of interests among the *industriels*, see Laufenburger and Pfimlin, *Cours d'économie alsacienne*, op. cit. (note 4), vol. 2, pp. 270–1.

³⁹ The standard history of the Société Industrielle in its first fifty years is Achille Penot, 'La Société Industrielle de Mulhouse', on pp. 1–136 of *Travaux et mémoires présentés à la Société Industrielle lors de la célébration du cinquantième anniversaire de sa fondation*, a supplement to volume 46 (1876) of the *Bulletin* of the society. See also *Centenaire de la Société Industrielle* (2 vols., Mulhouse, 1926), vol. 1, pp. 11–187.

⁴⁰ Jacques Koechlin was imprisoned specifically for the pamphlet, *Relation historique des événements qui ont eu lieu à Colmar, et dans les villes et communes environnantes, les 2 et 3 juillet 1822* (Paris, 1822), in which he criticized the provocative behaviour of the civil and military authorities in the arrest and execution of the Bonapartist conspirator, lieutenant-colonel Joseph-Augustin Caron.

In fact, the masonic associations of the Société Industrielle were even stronger than I indicate in the text, for another three of the founder-members subsequently joined the Parfaite Harmonie lodge. See Max Koehnlein, 'Un inspirateur de la Société Industrielle treize ans avant sa fondation', *Bulletin de la Société Industrielle de Mulhouse*, 99 (1933), 453–62 (458).

pervaded the Parfaite Harmonie lodge helped to invest the Société Industrielle as a whole with an aura of liberalism and Bonapartism which condemned it in the eyes of the Bourbon authorities, while allowing it to appear in Alsace as a champion of local, as opposed to national, interests. But the broader ideology always remained implicit, buried beneath a commitment to acts of public utility which gained in strength throughout the remaining decades of French rule. As I show in the next two sections, this sustained seriousness can be interpreted (in a manner with which historians are now very familiar) as a way of reinforcing a threatened social order; but it also produced lasting material benefits for industry and the community.

The Challenge to Authority

The reputation of the printed cottons of Mulhouse was such that by the early 1830s they had largely eliminated their British rivals from the French market and made some modest inroads on foreign markets as well. The quality of the *toiles peintes* of Dollfus-Mieg et Cie was such that in 1834 half of the company's production was sold abroad.⁴¹ In order fully to appreciate the magnitude of this achievement, the natural disadvantages of the Mulhousien situation after the collapse of the Empire have to be borne in mind. Imported cotton which reached Rouen within hours of its arrival at Le Havre took three weeks on a difficult overland route to reach the Haut-Rhin. The improvement in communications which came with the opening of the Rhône-Rhine canal through Mulhouse in 1832 did little, if anything, to alleviate the problem, and it was only in the 1850s, when the railway lines from the west via Strasbourg and later via Belfort were opened, that significant reductions in time and expense were achieved.⁴²

So the expansion that occurred in the twenty years or so following the return of the Bourbons must be regarded, by any standards, as impressive. It is not surprising that the *industriels* of the regions seized every opportunity of flaunting their success before their workers and the governments whose policies could do so much to reinforce or impede their efforts. When Charles X visited Alsace in 1828, the Société Industrielle resolved on a particularly extravagant display of regional pride, through an exhibition demonstrating the industrial strength of the Haut-Rhin. For the occasion, the most entrenched political principles were laid aside. Even the

The establishment of the Parfaite Harmonie lodge was part of a revival of masonic activity which occurred widely in Alsace. The lodge was an important focus for liberalism and bonapartism in the Restoration, though in later years, especially after 1848, it came to be more closely associated with republicanism. See Paul Leuillot, 'Bourgeoisie d'Alsace et Franc-Maçonnerie aux XVIIIe et XIXe siècles', in *La bourgeoisie alsacienne. Études d'histoire sociale* [Publications de la Société Savante d'Alsace et des Régions de l'Est, no. 5] (Strasbourg, 1967), pp. 343–76 (362–5).

⁴¹ Lévy, *Histoire économique de l'industrie cotonnière en Alsace*, op. cit. (note 4), p. 234.

⁴² Claude Fohlen, *L'industrie textile au temps du Second Empire* (Paris, 1956), p. 139. Fohlen does note, however, that the opening of the canal did help to alleviate (though it never solved) the very serious problem of obtaining cheap coal in the Mulhouse area; see note 88, below.

declared Bonapartist Nicolas Koechlin brought himself to make a respectful public address to the king and subsequently to accept the rank of Chevalier of the Legion of Honour (though in 1830 he duly reverted to type by voting in the Chamber of Deputies for the overthrow of the Bourbon line).⁴³

Despite their understandable pride, the readiness of the Mulhousien industrialists to be involved in the civic junketings that accompanied the royal visit is striking. It seems that a concern about recent developments in the economy and society prevailed over a public stance, with its origins way back in the days of the republic, which in principle should have brooked no show of sympathy to the Bourbons. The fall in the price of spun cotton and printed cottons in the crisis of 1827 and 1828 had already caused unemployment in Alsace as it did in other parts of France, as well as some bankruptcies among the smaller, less versatile firms. At a more general level, there were also signs that the élite's command of local affairs might be diminishing. The long-term cause of this was demographic change on a grand scale. The growing need for labour had led, since the Empire, to an influx of Catholics from the surrounding area, including parts of Bavaria and Wurtemberg across the Rhine. In 1803, Mulhouse had had only 600 Catholics in a total population of nearly 7000: by 1834, after three decades of steady immigration, roughly half the population of 13,300 was Catholic.⁴⁴ The resulting gulf between employer and employee was further widened by the dismal conditions in which the Catholic immigrants lived. About 1830, half of the workforce lived outside the town, and journeys on foot of six miles each way between home and workplace were common. Moreover, those who resided in the town lived in a squalor that appalled even the case-hardened Louis Villermé when he went there in 1835 and 1836. These were the days when the newspapers of Mulhouse would carry announcements advertising space to let not in a house but in a bed,⁴⁵ and when, as Villermé observed, two families would commonly share one squalid room in a lodging house to avoid the debilitating trudge

⁴³ The exhibition of 1828 is described in 'Rapport sur l'exposition des produits de l'industrie, à l'occasion de l'arrivée du roi, le 11 septembre 1828', *Bulletin de la Société Industrielle de Mulhouse*, 2 (1828), 73–166. On the visit of the king to Mulhouse see P. J. Fargès-Méricourt, *Relation du voyage de Sa Majesté Charles X en Alsace* (Strasbourg, 1829), pp. 145–60. Despite the fuss, the visit to Mulhouse lasted a mere 4½ hours.

It cannot have been easy for Koechlin to show public enthusiasm for the royal visit, but for him, the fall of Villèle's reactionary ministry in January 1828 would certainly have resurrected hopes of some liberalization of the Bourbon régime which he professed to despise. Koechlin also became involved in the visit as the most generous of the *industriels* who financed the elegant residential and commercial development known as the New Quarter. Both the king's visit and the exhibition of industry were organized in ways that drew attention to the magnificence of the new buildings and so, indirectly, celebrated its sponsors. It is typical of Koechlin's opportunism that after making his address, he presented the king with a written statement of the needs of Mulhousien industry; see Fargès-Méricourt, *Relation du voyage de Charles X*, p. 153.

⁴⁴ See Table 3. As the Table shows, the trend continued. Thirty years later, Catholics outnumbered Protestants in the ratio of three to one.

⁴⁵ See Penot's obituary of Nicolas Koechlin, cited in note 11, p. 202.

between Mulhouse or the industrial suburb of Dornach and an outlying village.⁴⁶

The publication of Villermé's *Tableau de l'état physique et moral des ouvriers* in 1840 gravely embarrassed employers whose public face of Calvinist piety and charity could not be made to square with the revelations. Only Lille, it was said, could match the Haut-Rhin in the degradation suffered by its cotton-workers.⁴⁷ In both towns, the hours were long. In summer, when work was plentiful, the working day in spinning and weaving would begin at 5 a.m. and end at 8 or 9 p.m., fifteen hours or more, with breaks amounting to no more than 1½ hours. The consequences were entirely predictable. Inadequate food and housing went hand in hand with rampant illegitimacy and a pitiful standard of health that explained the expression 'Nègres-Blancs' used to describe the pallid inhabitants of Thann and Mulhouse. Villermé's indictment confirmed the suspicions which Frenchmen outside Alsace had harboured and which loyal Mulhousiens had vehemently denied for many years past.⁴⁸ As early as 1809 Samuel Widmer had been shocked by the appalling conditions in which calico-printers at Wesserling were expected to work, with temperatures in the printing shed rising to 40°C.⁴⁹ And in 1824 the prefect of the Haut-Rhin had stated (with confidence and obvious satisfaction) that the Catholic, German-speaking population of his department was totally antipathetic to the Koechlin clan.⁵⁰ All this may well have been true, but the sense of misery and discontent did not begin to harden into systematic disaffection before the mid-1830s, when a period of particularly rapid

⁴⁶ Louis Villermé, *Tableau de l'état physique et moral des ouvriers employés dans les manufactures de coton, de laine et de soie* (2 vols., Paris, 1840), vol. 1, p. 27.

⁴⁷ *Ibid.*, vol. 1, p. 439. The information that I give on Mulhouse is taken from vol. 1, pp. 14–61 and 437–46.

⁴⁸ For a typically indignant riposte to the charges, see Penot, *Statistique générale du Haut-Rhin*, op. cit. (note 30), pp. 316–17:

The criticisms of those industries which employ large numbers of workers in one building . . . have been directed chiefly at spinning. The criticisms have been exaggerated. No, our workers are not the pinched, stunted creatures that they are said to be . . .

Needless to say, Penot did not mention that, in 1827, a committee of the Société Industrielle de Mulhouse had declined to take action on a proposal by one of the more compassionate employers, the spinner Jean-Jacques Bourcart of Guebwiller, for the imposition of a limit of twelve hours on the working day in spinning mills and a ban on the employment of children under the age of nine. For Bourcart's proposal, which was modelled on the British legislation of 1825 on working hours and the employment of children, see *Bulletin de la Société Industrielle de Mulhouse*, 1 (1826), 373–86. The proposal was rejected on the grounds that it would infringe the personal freedom of employer and employee alike.

⁴⁹ Chassagne, *Oberkampf*, op. cit. (note 16), p. 218, and 'Lettres écrites d'Alsace', op. cit. (note 23), p. 111.

⁵⁰ Leuillot, *L'Alsace au début du XIXe siècle*, op. cit. (note 4), vol. 1, p. 444. The statement by Puymaigre, a prefect of unimpeachable loyalty to the Bourbons, was made at the time of the elections of 1824. His belligerence towards the Koechlins is reflected very clearly in his comment: 'nous allons voir si c'est la famille des Bourbons ou la famille Koechlin qui gouverne le Haut-Rhin'. In the event, Jacques Koechlin was re-elected, but the larger vote for the other deputy, a legitimist, justified Puymaigre's view that the liberal cause had suffered since the previous elections in 1821.

immigration was followed by a sudden crisis in the spring of 1837, which caused sackings, short-time working, and even some closures.⁵¹

Despite the long history of the underlying causes, the publication of Villermé's book coincided with, and almost certainly contributed to, an unprecedented level of social unrest. Whereas in the 1830s there had been no disorder remotely comparable with that in Lyon in 1831 and 1834, new economic problems in 1846–8 provoked major disturbances (including a notorious bread riot in 1847) and, in response, shows of military strength which on one memorable occasion brought a leading employer, Jean Koechlin-Dollfus, face to face with the mob in his capacity as commander of the town's National Guard.⁵²

A quite different challenge to the authority of the *industriels* arose from another protracted process which threatened their carefully contrived command of all the main seats of power in the region. Their dominant position in the Town Council, the Parfaite Harmonie lodge, the Société Industrielle, and the Chamber of Commerce remained secure enough until well into the Second Empire, but in the middle decades of the nineteenth century rival élites did begin to emerge, chiefly as a result of the expansion of governmental bureaucracy. From as early as the 1820s, pretensions to autonomy, in accordance with the old tradition of independent rule by a closed community of burghers, were increasingly seen, from Paris, as impediments to the ideals of tidy centralization and political conformity. Conflicts, amounting on occasions to a running battle, were inevitable.

One early skirmish, which illustrates very clearly the icy welcome awaiting the government officials who were unlucky enough to find their way to Mulhouse, concerned the building of the Rhône-Rhine canal. Plans for this work had been gestating since the eighteenth century, and construction had begun in 1785. But it was only after the Empire, when the slowness and the high cost of transport were recognized as major constraints on local manufacturing, that the *industriels* of the Haut-Rhin began to press for completion of the canal, on the understanding that it would pass through Mulhouse. Military considerations helped to engage the government's interest, but they also dictated a route through quite unsuitable terrain which their engineers, if given a free hand, would probably never have chosen. Seepage proved to be a constant problem and a source of delays well calculated to elicit the derision of men who were convinced that the competence of outsiders could never match that of the home-grown Mulhousien product. At last, the point was made explicitly.

⁵¹ Villermé, *Tableau de l'état des ouvriers*, op. cit. (note 46), vol. 1, p. 24n. Villermé (ibid., vol. 1, pp. 14–18) noted the marked demographic change that occurred in a period of less than two years in the mid-1830s. In April 1834, 4,960 of the 9,860 workers in the cotton mills of Mulhouse lived in the town, 4,900 of them in surrounding villages; by the end of 1835, of a total of 11,637 workers, 6,573 lived in the town, with only 5,064 coming from outside.

⁵² Achille Penot, 'Notice sur M. Jean Koechlin-Dollfus', *Bulletin de la Société Industrielle de Mulhouse*, 41 (1871), 52–61 (57).

In 1828, in what was ostensibly a purely academic paper on local geology, Édouard Koechlin delivered a devastating criticism of the Ponts et Chaussées engineers who had undertaken (and bungled) the preliminary surveys for the canal.⁵³ Coming from someone who had no formal qualifications in either geology or civil engineering, it was an audacious attack, but it almost certainly represented the collective opinion of the *industriels*. It is hard to imagine that a pained defence of the Corps des Ponts et Chaussées, which was published soon afterwards,⁵⁴ was given much of a hearing.

An even more intrusive form of bureaucratization was apparent in education. Here, to a remarkable degree in the early nineteenth century, Mulhouse had stood apart from the rest of France. In the characteristic manner, local educational policy had been directed at independence and self-sufficiency, and that aim had been achieved through private patronage bestowed preferentially on ventures adapted to industrial employment. It was the generosity of André Koechlin, Jean Dollfus, and the firm of Nicolas Koechlin et frères, for example, which allowed the *collège communal* of Mulhouse to offer teaching in industrial chemistry, including some laboratory instruction, from 1822.⁵⁵ The innovation was an important one, and enrolments and academic standards rose steadily. From 1854, both the lectures and the practical classes were integrated in the curriculum of the new municipal *École Professionnelle*, with the young Paul Schützenberger taking charge of the laboratory; and in 1866 the teaching of chemistry was removed to a new *École Supérieure de Chimie* which, especially after the annexation, attracted a dazzlingly international body of students, chiefly from Alsace but also from Russia, Germany, France, Austria, Switzerland, and Italy.⁵⁶

Although Mulhouse earned its reputation in industrial education chiefly for the teaching of chemistry, there were other important developments for which the Société Industrielle and the town council, in varying degrees though with a clear community of interests, were responsible. These included schools of design (1829), weaving (1861), spinning (1864), and commerce (1866). Invariably, the emphasis in these local ventures was on strictly vocational training for what the promoters defined as the needs of Mulhousien industry, with national examinations and non-vocational subjects having virtually no place. It is all too easy, and

⁵³ Édouard Koechlin, 'Aperçu géologique sur les environs de Mulhouse', *Bulletin de la Société Industrielle de Mulhouse*, 2 (1828), 258–76 (276).

⁵⁴ *Bulletin de la Société Industrielle de Mulhouse*, 3 (1829), 1–21.

⁵⁵ On the history of the teaching of industrial chemistry in Mulhouse, see (in addition to the standard works cited in note 4) *Histoire de l'École de Chimie de Mulhouse publiée à l'occasion du 25e anniversaire de l'enseignement de M. le Dr Emilio Noelting 1880–1905* (Strasbourg, 1905), especially pp. 1–45, and Raymond Oberlé, *L'enseignement à Mulhouse de 1798 à 1870* (Paris, 1961), pp. 215–17. Oberlé's book is an invaluable source for all aspects of the history of education in Mulhouse.

⁵⁶ See the Tables on pp. 31–5 of *Histoire de l'École de Chimie*, op. cit. (note 55), pp. 31–5. The largest categories of students in the period 1879–1905 were: Alsatian (37.93%), Russian (15.60%), German (9.16%), French (8.32%), Austrian (8.06%), Swiss (7.47%), and Italian (6.24%).

profoundly misleading, for these schools to be disregarded as minor appendages to the national system of education. In fact, the schools of Mulhouse were typical of a world of locally supported vocational training over which the Ministries of Public Instruction and Commerce had no jurisdiction. There is an obvious parallel, for example, in the school for the instruction of the operatives of steam-engines, established in 1858 by the Société des Sciences, de l'Agriculture et des Arts in Lille.⁵⁷ Just as the École des Chauffeurs in Lille responded to the startling growth in the number of steam-engines in the region (nearly 2,000 were in use in the department of the Nord in 1858), so the schools of weaving and spinning in Mulhouse followed on the heels of the introduction of the technically advanced power looms and self-acting mules which I discuss later in the paper.

The enthusiasm of the *industriels* for their own schemes of vocational education contrasts unmistakably with their relative indifference to initiatives emanating from Paris. For example, they seem never to have campaigned for the establishment of a *lycée* in the town; the *collège communal*, despite its formally lower status, served their purposes adequately.⁵⁸ And they did little more than acquiesce in the creation of the École Préparatoire à l'Enseignement Supérieur des Sciences et des Lettres in 1855.⁵⁹ The explanation for this coolness is simple. For although the school was a municipal one, it was established in accordance with a plan for the extension of higher education in the industrial areas which emanated from the Ministry of Public Instruction, specifically as the brainchild of the Minister, Hippolyte Fortoul. The industrial employers of Mulhouse could not have overlooked the general drift towards academic centralization which the new Écoles Préparatoires were intended to promote,⁶⁰ and they can have had little sympathy for a curriculum which led, after two years of study, to an examination embracing geography, French history, and literature, as well as scientific and technical subjects, and to the award of a ministerial *certificat de capacité* which in the event proved worthless. It is hardly surprising that, in the absence of active encouragement on the part

⁵⁷ On this school, see 'Séance d'installation de l'École gratuite des Chauffeurs', in *Mémoires de la Société Impériale des Sciences, de l'Agriculture et des Arts de Lille*, 2nd ser. 5 (1858), v–viii.

⁵⁸ As mayor from 1836 to 1843, André Koechlin was a powerful opponent of any attempts to reduce the emphasis of the *collège* on scientific and industrial studies and to extend its very limited teaching in Greek and Latin. During the mayoralty of Émile Dollfus (1843–8), a different philosophy prevailed, and the *collège* assumed increasingly the character of a *collège royal* without ever being formally designated as such. See Oberlé, *L'enseignement à Mulhouse*, op. cit. (note 55), pp. 132–47.

⁵⁹ On the establishment of the École Supérieure, see Oberlé, *L'enseignement à Mulhouse*, op. cit. (note 55), pp. 197–205. The pamphlet *Inauguration de l'École Préparatoire à l'Enseignement Supérieur des Sciences et des Lettres de Mulhouse*, published to mark the opening of the school on 17 November 1855, is also helpful. Comparable schools were established at the same time in Rouen, Angers, and Nantes, in an attempt to meet the new demands being made on the educational system as a result of economic and demographic change. The instruction, which lasted two years, was practical in orientation, adapted to the needs of young people entering industrial and commercial careers for whom the more advanced and 'purer' curriculum of the faculties was inappropriate.

⁶⁰ For a comment on Fortoul's desire for centralization and its consequences see Robert Fox, 'Science, the university, and the state in nineteenth-century France', in Gerald L. Geison (ed.), *Professions and the French state, 1700–1900* (Philadelphia, 1984), pp. 66–145 (86–92).

of the *industriels*, enrolments in Mulhouse fell to an extremely low level: in the late 1860s the total number of students was even in single figures.⁶¹

For my present purpose, the main significance of the *École Préparatoire* lies in its contribution to the accelerating erosion of the old social order of Mulhouse. Like the *collège communal* and the *École Professionnelle*, the *École Préparatoire* brought to Mulhouse educated Frenchmen who often had no allegiance to Alsace, still less to her Calvinist textile manufacturers. Predictably, there were those among the newcomers who found the Alsatian speech and the drab utilitarianism of the town as hard to take as Émile Souvestre had done in 1836. One new arrival who recorded some particularly vivid impressions was Émile Boissière, who was appointed in 1855 to teach literature in the *École Préparatoire* and the *collège*. After two hours in Mulhouse, Boissière was on the point of returning hot foot to Paris,⁶² though eventually he stayed for twenty years, in the course of which he saw a modest degree of gaiety and sophistication injected into Mulhousian polite society, chiefly through the influence of the professional men and administrators from outside Alsace of whom he was typical. The removal of the *Sous-Préfecture* and some associated legal officials from Altkirch to Mulhouse in 1857 was, in this respect, an important new departure.⁶³ It was a departure which the tight-knit industrial and municipal élite cautiously welcomed as signalling the growth of their town, and as an inevitable rationalization. Yet its contribution to the growing pluralism among the *notables* of Mulhouse can hardly have been missed. The price to be paid was certainly not negligible.

Confronted, on the one hand, with an increasingly restless workforce and, on the other, with new contenders for authority, the *industriels* resorted once again to paternalism. Earlier in the century, the encouragement of savings banks and mutual aid societies, subsidized pharmacies, lending libraries in factories, and piecemeal masonic philanthropy had been adequate instruments of control. But by the 1850s, with a population almost three times what it had been thirty years before and with Saint-Simonian, Fourierist, and socialist ideas beginning to exert a tardy influence on the nature of workers' aspirations and on their forms of collective action, the response was necessarily on a rather grander scale. Now, in a scheme that was initiated by the *Société Industrielle*, the workers whose pitiful conditions Villermé had deplored only a few years before

⁶¹ Oberlé, *L'enseignement à Mulhouse*, op. cit. (note 55), pp. 207–10. As Oberlé notes, the shortage of students was equally marked in the other *Écoles Préparatoires*.

⁶² Jean-Louis-Émile Boissière, *Vingt ans à Mulhouse 1855–1875* (Mâcon, 1876), p. 7.

⁶³ Boissière noted the importance of this administrative change; see *ibid.*, p. 121. It seems that the *salon* organized by the new sub-prefect was an object of particular interest, though *salons* were by no means unknown in Mulhouse by the mid-century, as Boissière's comments on gatherings presided over by Madame Nicolas Koechlin make clear.

According to the *Histoire documentaire de l'industrie de Mulhouse*, op. cit. (note 4), vol. 1, p. 130, the town council of Mulhouse had petitioned on several occasions since 1814 for the transfer of the *Sous-Préfecture* from Altkirch to Mulhouse. The transfer necessarily entailed that of the *tribunal de première instance* (the main regional court) as well.

were provided with a model town, close to some of the main factories, that is still impressive even today.⁶⁴ It was a scheme for which the leading promoters, Jean Zuber *fils*, Jean Dollfus, and Dollfus's son-in-law Frédéric Engel-Dollfus, expected and justly received much credit, though the conception was certainly derived from Henry Roberts's *The dwellings of the labouring classes* (1850).⁶⁵ By 1864, after twelve years of development and an investment of 1 $\frac{3}{4}$ million francs, the Société des Cités ouvrières had erected 616 houses, each with a garden, and many of the occupants were well on the way to full ownership of their homes.⁶⁶

It is hard to overstate the importance of the years about 1850 as a turning-point in the history of the social structure of Mulhouse. The intrusion of central government in the affairs of the town, and the increase in population (to which the Cités ouvrières contributed by encouraging immigration from the countryside) were trends that the *industriels* were powerless to resist, even if they had wished to do so. It also seems that, among the younger leaders of Mulhousien industry who were now coming to prominence, the old traditions were not quite so sacred as they had been in the eyes of their parents and grandparents. This was in part an inevitable result of the passage of time, which had dimmed memories of the republic, even in the great families. Perhaps also the precepts of Pestalozzi and Fellenberg, which several members of the new generation had imbibed, must take some credit for a disinterested sense of social responsibility that their elders had conspicuously lacked.⁶⁷ At all events, Koechlin and Dollfuses who had once regarded it as essential to live in old family houses close to their factories were now tempted by a more gracious style of life, and there was, as a result, a growing tendency for them either to move out of the town altogether or to spend more time in their country houses, away from the smoke and simmering threat of disorder. The effect of this, allied to the growth of the Cités ouvrières, was unmistakable. Social segregation in the town was accelerated, with damaging consequences for the deteriorating relations between employer and employee to which I refer in the next section.

Science in the Industrial Context

By the mid-nineteenth century, Mulhouse vied with Rouen for the title of 'the Manchester of France'. It serves little purpose to rehearse the Mulhousien claims to this ambiguous distinction, but recent studies of

⁶⁴ On the history of the project and its realization, see Eugène Véron, *Les institutions ouvrières de Mulhouse et des environs* (Paris, 1866).

⁶⁵ Roberts's book was translated into French, at the request of the President, Louis-Napoleon, as *Des habitations des classes ouvrières* (Paris, 1850). Its effect in Mulhouse was further heightened by the publicity given to it at the time of the Great Exhibition of 1851, to which the Société Industrielle sent a deputation, and by a visit which Roberts made to Mulhouse.

⁶⁶ The scheme allowed for occupants to become the owners of their houses after paying rent (initially 22 francs a month) for twenty years.

⁶⁷ On this point, see René Martin, *La vie et l'oeuvre de Charles Dollfus (Mulhouse 1827–Paris 1913)* (Gap, 1913) pp. 17–21.

science in the British industrial setting inevitably provoke thoughts of a comparison. Was the Société Industrielle analogous to a Literary and Philosophical Society? Did science in Mulhouse have the ornamental character and social role which Arnold Thackray has ascribed to it in the case of Manchester?⁶⁸ Can the Koechlins be seen as the Alsatian counterparts of the Henrys or the Gregs?

Generally, I find the differences between the cultural history of Mulhouse and that of Manchester more striking than the similarities, especially when surface appearances are scraped away. I take as an illustration the drift from useful to polite culture which seems to have occurred among the élites of both towns. In the mid-1830s, the principal of the *collège municipal*, Verny, asked the Société Industrielle to take steps to remedy the cultural backwardness of Mulhouse. The tone of his address to the society was uncompromising.

. . . there are [he said] few towns of the size and industrial and political importance of Mulhouse which display such a great need in matters concerning the general cultivation of the mind . . .⁶⁹

The paucity of cultural provision at this time, as Verny's colleague Souvestre would have agreed, was very real. Yet Verny's scheme for public lectures to be presented 'in an easy and attractive style',⁷⁰ though briefly implemented, soon failed for lack of support.⁷¹ Two decades later, however, Achille Penot spoke of audiences for public lectures on science and literature which for some years past it had been impossible to accommodate in the lecture-room of the Société Industrielle.⁷²

At about the same time as this new polite audience emerged, there were also several *industriels* who turned to cultural pursuits of a non-utilitarian kind. One of the first to do so was Daniel Dollfus-Ausset, who gradually withdrew from his work as a calico-printer and textile chemist to devote himself to glaciology: from 1844 to 1865, his private field station on the Aar glacier was a mecca for geologists throughout Europe, and his thirteen-volume *Matériaux pour l'étude des glaciers* (1864) legitimated his claim to rank with Agassiz and others in the new speciality.⁷³ Later examples include Joseph Koechlin-Schlumberger, who practised as a field geologist of national standing in the 1850s and early 1860s (in addition to pursuing an

⁶⁸ Arnold Thackray, 'Natural knowledge in its cultural context: the Manchester model', *American historical review*, 79 (1974), 672–709.

⁶⁹ Louis-Édouard Verny, 'Proposition ayant pour objet d'encourager, sous les auspices de la Société Industrielle, le goût de la littérature et l'étude des sciences et arts', *Bulletin de la Société Industrielle de Mulhouse*, 7 (1834), 471–80 (473–4).

⁷⁰ *Ibid.*, p. 479.

⁷¹ Oberlé, *L'enseignement à Mulhouse*, op. cit. (note 55), pp. 239–40.

⁷² See p. 7 of the address which Penot delivered at the opening of the École Préparatoire in 1855, in his capacity as director of the school, reproduced in *Inauguration de l'École Préparatoire*, op. cit. (note 59). Quite separate but equally successful lectures were organized for working men and their families in the 1850s and 1860s; see Oberlé, *L'enseignement à Mulhouse*, op. cit. (note 55), pp. 241–6.

⁷³ Jean Weber, 'Notice biographique sur M. D^l Dollfus-Ausset', *Bulletin de la Société Industrielle de Mulhouse*, 41 (1871), 34–44 (38–43).

active career in public life),⁷⁴ and Jean Schlumberger, who turned in his later years from spinning to botany, entomology, and ancient and medieval history.⁷⁵

At first sight, it would appear that these cases exemplify the familiar three-generation pattern of movement away from industrial activity which Thackray describes with reference to the Henry family of Manchester.⁷⁶ But the movement in Mulhouse occurred more slowly than it seems to have done in Manchester. While the 'defections' are important, we should not overlook the vast size of the Mulhousien industrial clans and the continued involvement of the majority of their members in manufacturing, often in its most technical aspects. It would be absurd, of course, to pretend that the old families alone were responsible for the technological advances which characterized the cotton industry of Mulhouse in the 1840s, 1850s, and 1860s. They were not. I merely claim that their role remained a preponderant one.

It is true, as I argued earlier, that mechanization came late in southern Alsace. The earliest systematic use of power looms there dates only from 1826, when Isaac Koechlin introduced them at Willer,⁷⁷ and even at Dollfus-Mieg et Cie hand-looms were not finally abandoned until the 1850s.⁷⁸ In spinning, the self-acting mule was another late arrival, being first used (at Dollfus-Mieg) in 1852, a decade or more after it came into common use in England.⁷⁹ But, thereafter, the technical gaps in machinery which had long set Alsace significantly, if not very far, behind Lancashire was reduced. Major refitting in a number of the larger factories, most notably at Dollfus-Mieg, in the 1850s and early 1860s played an important part in this, as did a continuing tradition of indigenous mechanical invention. Josué Heilmann's comber was invented in Mulhouse in 1845, applied industrially in 1851, and quickly used elsewhere in Europe; and Émile Hübner's much faster circular comber followed a few years later.⁸⁰ It is noticeable that the inventions which originated in Alsace tended to be of particular benefit to the production of high-quality fabrics: the new combers, for example, were used in the

⁷⁴ Jean Weber, 'Notice biographique sur M. Joseph Koechlin-Schlumberger', *Bulletin de la Société Industrielle de Mulhouse*, 33 (1863), 535–53 (541–50); and Charles Grad, 'Études historiques sur les naturalistes de l'Alsace. Joseph Koechlin-Schlumberger 1796–1863', *Bulletin de la Société d'Histoire Naturelle de Colmar*, 14e et 15e années (1873–4), 283–314 (292–313).

⁷⁵ Sitzmann, *Dictionnaire de biographie des hommes célèbres de l'Alsace*, op. cit. (note 4), vol. 2, p. 691.

⁷⁶ Thackray, 'Natural knowledge in its cultural context', op. cit. (note 68), pp. 699–701.

⁷⁷ 'Résumé des notes laissées par M. Hartmann-Liebach', op. cit. (note 29), pp. 232–3.

⁷⁸ Ernest Zuber, 'Notice nécrologique sur M. Engel-Dollfus', *Bulletin de la Société Industrielle de Mulhouse*, 54 (1884), 267–95 (271–2).

⁷⁹ Dollfus, 'Notes pour servir à l'histoire de l'industrie cotonnière', op. cit. (note 29), p. 444. Although the self-acting mule was an English invention, the new machinery was supplied by André Koechlin et Cie. By 1853, 30,000 spindles of the new design were in use at Dollfus-Mieg et Cie; see Dollfus, *Histoire et généalogie de la famille Dollfus*, op. cit. (note 18), p. 506.

⁸⁰ Dollfus, 'Notes pour servir à l'histoire de l'industrie cotonnière', op. cit. (note 29), pp. 445–6, and Marie-Roch-Louis Reybaud, *Le coton. Son régime, ses problèmes, son influence en Europe* (Paris, 1863), pp. 44–7.

preparation of the superior sea-islands cotton (*coton longue soie*). But the readiness to accept techniques more directly adapted to mass production and the reduction of costs is also, by the mid-century, beyond question.

It seems clear that by about 1860 the Mulhousien textile industry had access to all the technology it needed and that, in one area at least, it led the world. I refer, once again, to textile chemistry. In his envious account of French activity in this field, published in 1860, the English colourist Charles O'Neill referred to France as a whole rather than to Mulhouse specifically. 'It may safely be said', he wrote, 'that for one person of an adequate chemical education connected with dyeing or printing in England, there are ten such in France; hence their high position in these arts with regard to the finer styles and qualities'.⁸¹ The generalized character of the comment should not deceive us, however. For the abundant references that litter his *Chemistry of calico-printing, dyeing and bleaching* make it very plain that Mulhouse was his model, and that the key to Mulhousien success lay above all in the Société Industrielle.

Ironically, the lead to which O'Neill referred may well have had damaging consequences for Mulhousien industry in the new age that dawned with the explosion of the artificial dyestuffs industry after W. H. Perkin's discovery of mauve in 1856. Until that date, the specialities of Mulhouse had been, perforce, natural dyes and their associated mordants. There was no one in the late 1820s, for example, who could match Henri Schlumberger's mastery of madder-based dyes and mordanting with oxides of iron. And, as Ernst Homburg has observed, the development of natural dyes was being pursued more vigorously and creatively than ever in the late 1840s and 1850s.⁸² In this later period, Dollfus-Mieg et Cie introduced the technique of animalisation, using albumine to fix dyes normally used for wool and silk on cotton and to create the new 'pigment colours' style. It was also in this period, in 1855, that Albert Schlumberger, then a colourist at the Wesserling firm of Gros, Roman, Odier, et Cie, showed how murexide could be used commercially as a cotton dye. Within a year or two, several firms in Mulhouse, including those of Frères Koechlin, Dollfus-Mieg et Cie, and Steinbach, Koechlin et Cie, were printing with murexide; and, before the decade was out, other new natural dyestuffs, notably the highly successful French purple, were introduced. The award of a medal to Perkin by the Société Industrielle in 1859⁸³ and

⁸¹ Charles O'Neill, *Chemistry of calico-printing, dyeing, and bleaching* (Manchester, 1860), p. iii. In fact, there is a slightly grudging air about O'Neill's comments on French supremacy. In his view (p. iv), the French tended to receive excessive credit for their work in calico-printing and related technologies because innovations made in Switzerland, Belgium, Northern Italy, and parts of Germany, as well as those made in France, were regularly announced in French journals, notably of course the *Bulletin de la Société Industrielle de Mulhouse*.

⁸² Ernst Homburg, 'The influence of demand on the emergence of the dye industry. The roles of chemists and colourists', *Journal of the Society of Dyers and Colourists*, 99 (1983), 325–34 (329–3). Homburg's work forms part of a broader study of the development of the dye industry now nearing completion under the direction of Dr W. J. Hornix of the University of Nijmegen.

⁸³ *Bulletin de la Société Industrielle de Mulhouse*, 30 (1859), 225.

the research of the young Horace Koechlin, as well as Albert Schlumberger's own work, show that Mulhouse in no way turned its back on aniline dyes. Jean Gerber-Keller, now known chiefly for his central role in the Fuchsine case of 1863, was another Mulhousien who immediately espoused the new technology, developing his ideas in the familiar context of the chemical committee of the Société Industrielle.⁸⁴ Yet there can be no denying that, with the coming of the new dyes, the centre of research and production in textile chemistry shifted unmistakably from the once fertile ground of southern Alsace to Lyon and Paris.

It is tempting to suggest that the decades of Mulhousien success with natural dyestuffs inhibited an immediate recognition of the commercial superiority of the far cheaper coal-tar products, so allowing competitors elsewhere in France and in Germany and Britain to edge ahead.⁸⁵ In his report on the artificial dyestuffs displayed at the 1862 Exhibition in London, A. W. Hofmann predicted a brilliant future for aniline dyes.⁸⁶ But even if many natural dyestuffs (murexide in particular) had had their day, it was not obvious to Hofmann that all of them would necessarily be eclipsed. In a comment that helps us to understand Mulhousien conservatism, he spoke of a continuing 'struggle' between French purple and coal-tar purple in which the real advantages of the former ('fastness and resistance to the influence of light') would have to be weighed seriously.⁸⁷

The complete congruence between the style of chemical research pursued in Mulhouse and the industrial context that gave rise to it is, I believe, beyond question. It is scarcely less so in the case of another scientific tradition, concerned with theoretical and experimental research on the steam-engine. The industrial incentive for this research (much of it centred on the economies to be obtained by the use of steam jackets) is clear. The obstinately high price of coal, still three or four times that paid by English manufacturers, assumed a new importance in the 1850s and early 1860s, as the number of steam-engines in use in the Haut-Rhin

⁸⁴ On this case, in which Jean and Armand Gerber-Keller unsuccessfully challenged the claims of Renard frères to a monopoly on the manufacture of Fuchsine (or Magenta), see L. F. Haber, *The chemical industry during the nineteenth century. A study of the economic aspect of applied chemistry in Europe and North America* (Oxford, 1958), pp. 201–2, and other standard sources.

⁸⁵ The response of the most important chemical manufacturer in southern Alsace (the firm of Charles Kestner at Thann) is instructive. Kestner's cautious response to the opportunities presented by artificial dyestuffs contrasts markedly with the firm's long-standing activity in the preparation of natural dyes. According to the *Histoire documentaire de l'industrie de Mulhouse*, op. cit. (note 4), vol. 2, pp. 578–9, Kestner did manufacture aniline violet and other products related to the new technology. But the venture was soon abandoned, and Kestner reverted to the more traditional activities of the French heavy chemical industry, specializing in particular in the production of sulphuric acid; see Laufenburger and Pflimlin, *Cours d'économie alsacienne*, op. cit. (note 4), vol. 2, p. 80n, and Charles Grad, *Études statistiques sur l'industrie de l'Alsace* (2 vols., Colmar, Strasbourg, and Paris, 1879–80), vol. 1, pp. 308–9.

⁸⁶ See Hofmann's report on Class II ('Chemical and pharmaceutical products and processes'), in *International Exhibition of 1862. Reports by the juries on the subjects in the thirty-six classes into which the Exhibition was divided* (London, 1863), p. 136.

⁸⁷ *Ibid.*, p. 117.

increased nearly three-fold.⁸⁸ The earliest important work on steam power in Mulhouse, by Émile Koechlin, dates from the 1830s,⁸⁹ but the most distinguished contributions were unquestionably those which Gustave-Adolphe Hirn, an engineer and associate of the Haussmann family, began to make at le Logelbach in the early 1850s.

Both Koechlin and Hirn were very self-consciously Alsatian *savants*, though with differences that arise from a regional microstructure whose complexity the single term 'Alsatian' cannot convey. Hirn resembled Émile Koechlin and most other Koechlins in that he was a French-speaking Calvinist, born into a textile family, privately educated, and a member of the Société Industrielle. As a native of Colmar, however, he stood slightly apart from the Mulhousien industrial élite. While his protestantism made it difficult for him to contemplate an academic career in the national system of education, he deferentially courted the scientists of the capital and secured the favourable attention of Le Verrier, among others. Hirn, in fact, was seen in Paris as a useful auxiliary whose work was to be taken seriously. Hence I find it entirely predictable that his experimental demonstration that the amount of heat leaving a steam-engine in the condenser (Q_2 , in the conventional nomenclature) is less than the amount entering it through the boiler (Q_1) and that $(Q_1 - Q_2)$ is proportional to the work done was immediately recognized as a major contribution,⁹⁰ contributing to Hirn's eventual election as a corresponding member of the Académie des Sciences.

Although the science of Mulhouse never flagged or broke with its industrial roots, there were occasional signs, even before the mid-century, that the rising generations of the great families felt dissatisfied with the rather hermetic, self-contained character of cultural life in southern Alsace. When Frédéric Engel had shown an interest in the possibility of entering the École Polytechnique and pursuing a career in one of the state corps of engineers about 1830, his family soon convinced him of the error of his ways; he was rescued from the corrupting influence of Paris (where he was a pupil at the lycée Henri IV) and brought back to Mulhouse to serve an industrial apprenticeship and to marry a Dollfus.⁹¹ But a quarter of a

⁸⁸ According to Charles Thierry-Mieg, 'Rapport sur les forces matérielles et morales de l'industrie du Haut-Rhin, pendant les dix dernières années (1851-1861)', *Bulletin de la Société Industrielle de Mulhouse*, 32 (1862), 431-73 (459), the number of steam-engines in the Haut-Rhin increased from 163 (a total of 3,565 H.P.) in 1851 to 473 (11,027 H.P.) ten years later. The continuing concern about the price of coal is evidence of the limited advantages that were obtained by the opening of the Rhône-Rhine canal and the improvement of the railway network; see note 42, above.

⁸⁹ See, for example, Koechlin's huge 'Mémoire sur les machines à vapeur, sur des expériences comparatives à faire entre les divers systèmes de machines, et sur l'utilité que présenterait un ouvrage complet et classique sur cette partie essentielle de l'industrie manufacturière', *Bulletin de la Société Industrielle de Mulhouse*, 9 (1836), 79-182, and the related contributions by Joseph Koechlin and Choffel on pp. 183-277.

⁹⁰ The first report on Hirn's experiments, which were performed on a 120 H.P. Watt engine at le Logelbach, appeared in a letter he wrote to the President of the Société Industrielle de Mulhouse, dated 21 October 1854. See *Bulletin de la Société Industrielle de Mulhouse*, 26 (1855), 274-7.

⁹¹ Ernest Zuber, 'Notice nécrologique sur M. Engel-Dollfus', *Bulletin de la Société Industrielle de*

century later, the lure of the capital for the young Charles Dollfus, the son of Jean Dollfus, proved too much.⁹² After a conventional early education in Switzerland, an unhappy and unsuccessful year at the *École Centrale des Arts et Manufactures*, and one year in the law faculty at Strasbourg, Charles was totally seduced in Paris by the literary bohemianism which beguiled many another student of law. By 1851, at the age of twenty-four, he had already had the heady experience of being imprisoned for impiety for his Voltairian *Lettres philosophiques*. Thereafter, the prospect of a legal career in Colmar seemed insufferably tame, and he settled in the capital, swelling the ranks of the liberal journalists who flocked there during the Second Empire. He never returned to Alsace and did not go back on his early rejection of the industrial career which his father had envisaged for him.

The fragmentary nature of the evidence makes it difficult to identify the trends that characterized the decade or so preceding the war. But, as I have tried to show, in a variety of ways the power which a handful of families had managed to retain through nearly three-quarters of a century of French rule was at last slipping away from them. Between the 1850s and 1870, the trends which had begun to appear by the mid-century gathered pace. Not only did the old families have to contend with the challenge of rival élites in the bureaucracy and education, they also faced the first signs of insecurity within contexts which previously had been totally theirs to preserve. Even the *Société Industrielle de Mulhouse* lost some of its cosy cohesiveness. This was to a large extent a straightforward result of growth: between 1850 and 1870 the membership almost doubled in size, from 272 to 512. But it also owed something to the growing prominence of new men with a technical competence to match that of the established experts. As Laufenburger and Pflimlin pointed out long ago, the Second Empire saw the lead in some of the key activities of the society being taken by professional engineers who had been trained outside Mulhouse. Émile Burnat and William Grosseteste, both of them employed by Dollfus-Mieg et Cie, were typical of this new breed.⁹³

It is quite clear that, at the same time, changes were occurring inside the industrial élite as well. I have already referred to the signs of restlessness in the generation which came to maturity about 1850, the generation of Charles Dollfus. These signs coincided with other strains, notably in the solidarity which, at least in public, had always bound the employers to one another. In the early 1850s, there was the unseemly spectacle of an all too visible dispute between André Koechlin et Cie and Nicolas Schlumberger *Mulhouse*, 54 (1884), 267–95 (268–9), and Xavier Mossmann, *Vie de F. Engel-Dollfus* (Paris, 1887), pp. 7–8.

⁹² For a detailed biography of Dollfus, see Martin, *La vie et l'oeuvre de Charles Dollfus*, op. cit. (note 67). A contemporary of Dollfus who 'escaped' at about the same time was Charles Schlumberger. In the late 1840s, Schlumberger entered the *École Polytechnique* and went on to a career in state employment, as a marine engineer, and to a consuming vocation as a naturalist.

⁹³ Laufenburger and Pflimlin, *Cours d'économie alsacienne*, op. cit. (note 4), vol. 2, p. 286.

et Cie over the right to manufacturer Hübner's carder.⁹⁴ And worse was to follow in the 1860s, as free-traders, led by Cobden's friend Jean Dollfus, confronted protectionists, most of them the smaller spinners and weavers whose activities were gravely affected by the entry into France of cheap British products following the Chevalier–Cobden Treaty of 1860.⁹⁵

These confrontations would not have been so damaging to the interests of the *industriels* if they had not been accompanied by a new unity among their employees (a growing proportion of whom were now engaged in the less well protected industries of spinning and weaving, rather than in calico-printing, as Table 4 shows). There can be no doubt that unity owed much to the improved living conditions which the employers had helped to promote. For, as recent work in the urban history of nineteenth-century France has shown, the emergence of organized working-class protest depended on the existence of a settled, close-knit community: the semi-migrant workers of the 1830s, for example, were far less likely to be stirred to political action than men who had lived for a decade or more in the *Cités ouvrières*.⁹⁶ Electoral reform, too, played its part: since 1848, an extended franchise had given the textile workers an unprecedented grip on their destinies and a new way of demonstrating the opposition to free trade which most of them felt. Between 1861 and 1865, the cotton famine accompanying the American civil war and the resulting closures and short-time working served to polarize opinion still further and to create a degree of social dislocation that would have been inconceivable in Mulhouse only twenty years before. In the later 1860s, the industrial unrest which affected many parts of France was particularly acute in southern Alsace.⁹⁷ Hence, with the benefit of hindsight, it does not seem at all surprising (though it seemed so at the time) that when the venerable Jean Dollfus stood for re-election as one of the deputies for the Haut-Rhin in 1869, the impotence of the old paternalism was ruthlessly laid bare. Dollfus was defeated by a more radical candidate, and in the following year, only days before the war with Prussia was declared, every factory in Mulhouse and most of those elsewhere in the department were on strike.⁹⁸

In these circumstances, Bismarck had little difficulty in persuading the working population of the Haut-Rhin that their destiny lay with the new German Empire rather than as the vassals of an industrial aristocracy

⁹⁴ *Histoire documentaire de l'industrie de Mulhouse*, op. cit. (note 4), vol. 1, p. 230.

⁹⁵ On this issue, see, in addition to the standard sources, Mossmann, *Vie de F. Engel-Dollfus*, op. cit. (note 91), pp. 28–39. Frédéric Engel-Dollfus was deeply involved in the debate, taking the side of his father-in-law, Jean Dollfus, along with most of the large calico-printers.

⁹⁶ The correlation between a settled, concentrated community and a capacity to organize working-class protest is a recurring theme in John M. Merriman (ed.), *French cities in the nineteenth century* (London, 1982). See especially Merriman's Introduction and the contributions by Charles Tilly and Michael P. Hanagan.

⁹⁷ Fernand L'Huillier, *La lutte ouvrière à la fin du Second Empire* (Paris, 1957), pp. 59–72.

⁹⁸ On the elections, see André Brandt and Paul Leuillot, 'Les élections de Mulhouse en 1869', *Revue d'Alsace*, 99 (1960), 104–28.

that disdained their language and did not even share the Catholicism which by now the overwhelming majority of the population professed.⁹⁹ Needless to say, the response of the main *industriels* was very different. Some of them transferred at least part of their manufacturing activity over the border into France, as a way of securing their access to the French market which, at the time of the annexation, absorbed the overwhelming majority of their products.¹⁰⁰ Others maintained their industrial interests in Alsace but moved their homes out of the area; the younger Antoine Herzog was among those who settled in Paris. But most of them stayed on, using the Société Industrielle as a bastion of French culture in an increasingly alien environment.¹⁰¹

In reality, the maintenance of a French cultural tradition was of little more than symbolic importance. Economically, the region was quickly and completely assimilated into Germany, despite early hopes that special terms might be arranged for the entry of Alsatian goods into France.¹⁰² Understandably, manufacturers across the Rhine were quite as dismayed by the assimilation as the Alsations themselves. They feared the competition of an industry which in the Haut-Rhin alone consumed as much cotton as the whole of the Zollverein and which possessed a technology far superior to their own. In this respect, the modernization of many factories in an around Mulhouse, which had proceeded at a remarkable pace since the 1840s (as the indicators in Tables 5, 6, and 7 show very clearly), had only served to aggravate the problem.¹⁰³ It both widened the technological

⁹⁹ See Table 3. In 'Les élections de Mulhouse en 1869', op. cit. (note 98), p. 124, Brandt and Leuillot give the following figures for the religious affiliations of the population of Mulhouse in 1866: Catholics 45,550, Protestants 11,211, Jews 1,939, others 73 (total 58,773). In Alsace as a whole, the proportion of Catholics to Protestants was slightly lower, being of the order of three to one.

¹⁰⁰ For a list of nine firms that developed manufacturing activities in France in the aftermath of the annexation, see Marie-Joseph Bopp, 'L'oeuvre sociale de la haute bourgeoisie haut-rhinoise au XIXe siècle', in *La bourgeoisie alsacienne*, op. cit. (note 40), pp. 387–402 (402). André Koechlin et Cie (assimilated from 1872 as part of the very successful Société Alsacienne de Constructions Mécaniques) was a particularly notable enterprise which began manufacturing in France (at Belfort), though it did not do so until 1879.

¹⁰¹ Jean Dollfus was the most notable of the public figures who stayed and remained loyal to the French traditions of Mulhouse. Despite his defeat in the elections of 1869 and his advanced age, he re-entered the world of politics as the deputy for Mulhouse in the Reichstag from 1877 to 1887.

¹⁰² The relative importance of French and foreign markets varied very considerably between the 1830s (when the export trade in textiles from Alsace prospered) and 1871. But exporting in this period was never an easy task. On the eve of the annexation, spinning and weaving were totally dependent on the home market, and only the calico-printers exported to a significant extent, 22 per cent of their production going abroad. In these circumstances, any reduction in the ease of access to French markets was a major blow. See Fernand l'Huillier, 'Deux siècles d'exploitation textile haut-rhinoise (1750–1950)', *Société Industrielle de Mulhouse. Bulletin trimestriel*, nos. 1–2 (1950), 111–22 (119–20).

¹⁰³ The Tables show very clearly the effects of the introduction of new and greatly improved machinery in the quarter of a century before the annexation. The main changes were: a) the continued rise in the number of spindles, especially after the introduction of the self-acting mule in the early 1850s, b) the rapid adoption of the power loom in place of the hand looms on which weaving still largely depended in the 1840s, and c) the increasing productivity of calico-printers (achieved at a time when the work force and the number of factories in this industry were diminishing). See also Table 8, which makes very clear the changing structure of the cotton industry in the Haut-Rhin, with the commercial importance of spinning and weaving overtaking that of calico-printing. The faltering authority of Jean Dollfus in the 1860s probably owed something to this trend, since, despite his interests in spinning and weaving, he always spoke as the representative of the calico-printers.

gap and convinced Bismarck that the prize of Alsace was one on which there could be no compromise.

Conclusion

I began this address with prescriptions about the writing of the history of French science, and it is with prescriptions—three of them—that I shall finish. My first concerns the administrative and intellectual centralization which is commonly supposed to have inhibited the creativity of scientists in France since the early decades of the nineteenth century.¹⁰⁴ As I indicated in my opening remarks, Parisian ministries—in particular Public Instruction and Commerce—constantly strove to tighten their control, and I have argued elsewhere that administrative pettiness, especially in the 1850s, drove a damaging wedge between French science and the science of other countries.¹⁰⁵ But I hope that this study of Mulhouse shows just how much of the realm of technical education and industrially related science escaped the net. As Terry Shinn has argued with reference to the moves to make French universities more independent between 1880 and 1914, explanations of the supposed decline of French science after about 1830 that invoke centralization are likely to be frail creatures.¹⁰⁶

My second prescription follows immediately from the first. It concerns the desirability of adopting a provincial as well as a Parisian perspective. As I have tried to show, most of the initiatives in industrial science and technology that emanated from the capital had little bearing on the industrial life of Mulhouse. It is significant and wholly in character that the *industriels* of the area displayed little interest in the Société d'Encouragement pour l'Industrie Nationale until the 1820s,¹⁰⁷ and that the three national exhibitions of French industry that were held during the Bourbon Restoration aroused only a patchy response in Mulhouse. At the first of them, in 1819, Mulhouse calico-printers won no fewer than seven gold medals, but in 1823 there were no exhibitors from the town, and in 1827 only three.¹⁰⁸ Clearly, in 1823 and 1827 the political objective of a public

¹⁰⁴ This explanation for the shortcomings of French science has a long history, going back to the mid-nineteenth century. By the time of the war of 1870, it had become a commonplace in the mounting demands for reform that were being voiced by Sainte-Claire Deville, Pasteur, and others; see Fox, 'Science, the university, and the state', op. cit. (note 60), pp. 105–6. For a classic statement of the ills of centralization in the modern literature on France, see Joseph Ben-David, *The scientist's role in society. A comparative study* (Englewood Cliffs, New Jersey, 1971), pp. 88–107.

¹⁰⁵ Fox, 'Science, the university, and the state', op. cit. (note 60), pp. 84–101.

¹⁰⁶ Shinn, 'The French science faculty system', op. cit. (note 3), *passim*, but especially p. 326. Shinn shows how difficult it is to establish any correlation between performance in research and the degree to which French science was subjected to close central control.

¹⁰⁷ Leuillot, *L'Alsace au début du XIXe siècle*, op. cit. (note 4), vol. 2, p. 379.

¹⁰⁸ *Ibid.*, vol. 2, p. 389n. Daniel Koechlin's indifference to the system of national exhibitions was flaunted in a characteristic way when he did not even bother to collect the gold medal (or the decoration of the Legion of Honour) that he was awarded in 1819. The more extreme royalist governments of the 1820s reciprocated the sentiment. At the 1827 exhibition, for example, the exhibits from Mulhouse were said (by Nicolas Koechlin) to have been relegated humilatingly to a remote corner. Under the July Monarchy, which the industrialists found politically more acceptable, Mulhousien involvement in the national exhibitions was more conspicuous. In 1834, firms in the

display of opposition to the Bourbons was seen as far more important than any economic advantages which a national exhibition might have bestowed.

Thirdly, and finally, a comment on the engaging subject of the social use of science. One of my main contentions about Mulhousien science and technology has been that its pristine seriousness was maintained almost unimpaired until 1870. Ornamental learning, purveyed through public lectures, made its appearance, as I have shown. But it was an additional, not an alternative cultural form, and never a prominent one. I know that, in making this point, I run the risk of being charged with a crude functionalism, with implying that the technical needs of the town's manufacturers stimulated an appropriate, ideologically neutral industrial science and that the interaction between economic substructure and scientific superstructure constitutes the whole story. In fact, it is my contention that the relentless utilitarianism of the debates and publications of the Société Industrielle can only be understood by also taking account of the non-technical priorities to which I have repeatedly referred. The promoting of polite lectures in the Parisian style would have undermined the distinctiveness of Mulhousien society; it would also have subverted the carefully maintained public face of Calvinist austerity and probity and so given the lie to a carefully fashioned rhetoric. Hence, in the context of Mulhouse, displays of ornamental learning and elegance, far from heightening social control and winning status (in the way they seem to have done in Manchester), would have served to weaken existing authority. It is perhaps all too easy to suppose that the social uses of science are something quite separate from its economic uses; in Mulhouse, one and the same activity achieved both social and economic aims.

In all this, historians of modern British science may feel that I have been speaking to the converted: in recent years, the fine structure of provincial activity in our own country has been perceptively explored, not least by my successor as president. But the comparable field in France is almost unploughed, despite the voluminous works that French social historians have devoted to the tiniest geographical contexts. Of course, we shall never understand the place of science in French society merely by walking the byways. But I suggest that we may have spent too long on the highways, viewing French science from the centre, as nineteenth-century ministers of education obfuscatingly intended that we should.

Tables

The Tables that follow are based primarily on statistical information in: Émile Dollfus, 'Notes pour servir à l'histoire de l'industrie cotonnière Haut-Rhin won 13 gold medals, 14 silver medals, and 9 bronze medals, and 5 *industriels* in the region were decorated with the Legion of Honour; see *Bulletin de la Société Industrielle de Mulhouse*, 7 (1834), 466–7.

dans les départements de l'Est', *Bulletin de la Société Industrielle de Mulhouse*, 27 (1855–7), 435–61.

Charles Thierry-Mieg, 'Rapport sur les forces matérielles et morales de l'industrie du Haut-Rhin, pendant les dix dernières années (1851–1861)', *Bulletin de la Société Industrielle de Mulhouse*, 32 (1862), 431–73.

Achille Penot, 'Notes pour servir à l'histoire de l'industrie cotonnière dans le département du Haut-Rhin', *Bulletin de la Société Industrielle de Mulhouse*, 44 (1874), 145–260.

Charles Grad, *Études statistiques sur l'industrie de l'Alsace* (2 vols., Colmar, Strasbourg, and Paris, 1879–80).

Marie-Roch-Louis Reybaud, *Le coton. Son régime, ses problèmes, son influence en Europe* (Paris, 1863).

The information given relates, except where stated, to the whole of the department of the Haut-Rhin.

TABLE 1. The chronology of industrial growth and innovation in the Haut-Rhin

1746	Establishment of the first calico-printing works in Mulhouse by Samuel Koechlin, Jean-Jacques Schmaltzer, and Jean-Henri Dollfus
1790	Wallpaper manufacture begun by Frères Dollfus et Cie
1800	Establishment of Dollfus-Mieg et Cie
1802	Opening of first spinning mill at Wesserling by Gros, Davillier, Roman et Cie
	Nicolas Koechlin et frères established by Nicolas Koechlin, following an apprenticeship served with his uncle, Daniel Dollfus-Mieg
	Jean Zuber et Cie, wallpaper manufacturers, established at Rixheim
1803	Flying shuttle in use at Wesserling
1804	Calico-printing with copper rollers practised at Dollfus-Mieg et Cie and Nicolas Koechlin et frères
1808	Establishment of Nicolas Schlumberger et Cie, cotton-spinners, at Guebwiller, later to become the largest spinning mill in France (37,500 spindles in 1826)
1812	First steam-engine employed in spinning, by Dollfus-Mieg et Cie
c. 1818	Henri Schlumberger and Daniel Koechlin-Schouch appointed as colourists by Mulhouse calico-printers
1818	Mathieu and Jérémie Risler establish machine construction works at Cernay, with Job Dixon
c. 1820	Chlorine bleaching in general use, though first used by J. M. Haussmann at le Logelbach in 1791
1826	Establishment of André Koechlin et Cie, engineers
1827	Power looms first used, by Isaac Koechlin at Willer (designed by Josué Heilmann, constructed by André Koechlin et Cie)

TABLE 1 (*cont.*)

c.1830	Machinery for calico-printing in two colours introduced at Dollfus-Mieg et Cie by Daniel Dollfus-Ausset
1839	Manufacture of worsted wool begun
1845	Invention by Josué Heilmann of Heilmann combing-machine, subsequently improved by Jean-Jacques Heilmann and Henri Schlumberger and manufactured by Nicolas Schlumberger et Cie
1852	Self-acting mule introduced in spinning
1853	Manufacture of the Hübner comber by André Koechlin et Cie. Widely used from the late 1850s, notably by Dollfus-Mieg et Cie
1856	Murexide introduced as a dyestuff for cotton
1858	Mauve (aniline violet) in industrial use
1859	First use of French purple and Fuchsin

TABLE 2. The population of Mulhouse, 1798–1870

<i>Date</i>	<i>Total</i>
1798	6,018
1800	6,618
1805	8,021
1810	9,353
1815	9,350
1820	9,598
1825	12,038
1830	13,231
1835	13,804
1840	17,250
1845	23,393
1850	29,268
1855	29,574
1860	45,981
1865	56,541
1870	65,000

TABLE 3. Religion in Mulhouse

<i>Date</i>	<i>Protestants</i> (%)	<i>Catholics</i> (%)	<i>Jews</i> (%)
1803	91	9	? ¹
1834	50	50	? ¹
1851	43	57	? ¹
1865	25	75	? ¹
1875	26	74	? ¹
1888	27	70	3%
1899	23	72	5%

¹ Information about the Jewish community in Mulhouse for these dates is sparse, but the population was probably of the order of 2–3%, representing a population numbering a few hundred.

TABLE 4. Number of operatives employed in the cotton industry

<i>Date</i>	<i>Spinning</i>	<i>Weaving</i>	<i>Calico-printing</i>
1827	10,240	23,352	11,248
1846			c. 10,000
1851	c. 14,000	c. 19,000	
1856			9,765
1861	c. 14,000	c. 22,000	
1871	12,245	33,243	8,611

TABLE 5. Number of spindles (cotton)

<i>Date</i>	<i>No.</i>
1810	24,000
1812	47,508
1827	466,363
1834	540,000
1839	683,000
1844	763,734
1849	786,312
1855	912,000
1859	1,154,220
1864	1,234,626
1866	1,428,850 ¹
1871	1,411,011

¹ The level of activity in spinning in each of the two other main centres of the cotton industry in France at this time—Lille-Roubaix-Tourcoing and Seine-Inférieure (chiefly Rouen, Elbeuf, and Le Havre)—was roughly comparable. To obtain an impression of the importance of these activities in the general European context, the figures given have to be compared with the 40 million spindles that were in use in the United Kingdom in the late 1860s and the 3 million of the German Zollverein. The corresponding figure for the whole of France was 6,800,000.

TABLE 6. Mechanization of cotton weaving

<i>Date</i>	<i>Number of power looms</i>	<i>Number of hand looms</i>
1831	426	21,651
1834	3,090	31,000
1839	6,000	
1844	12,000	19,000
1856	18,139	8,657
1864	24,133	3,000–4,000
1865	24,646	3,000–4,000
1866	30,421	3,000–4,000

TABLE 7. Production of printed cotton

<i>Date</i>	<i>Factories</i>	<i>Metres of fabric produced</i>
1798		2,500,000
1828	27	17,949,790
1836	35	
1847	20	37,800,000
1856	21	49,000,000
1862	18	50,000,000
1867	14	65,000,000
1871	18	82,537,934

TABLE 8. Turn-over in the major industries

<i>Date</i>	<i>Calico-printing (M francs)</i>	<i>Weaving (M francs)</i>	<i>Spinning (M francs)</i>
1828	33 ¹	20	16
1862	50 ¹	70	60

¹ On p. 447 of his 'Rapport sur les forces matérielles et morales de l'industrie du Haut-Rhin' (see list of sources for these Tables), Charles Thierry-Mieg contrasts the modest growth in this industry with that in England, where the comparable figures were 100 million francs for 1828 and 300 million francs for 1862.