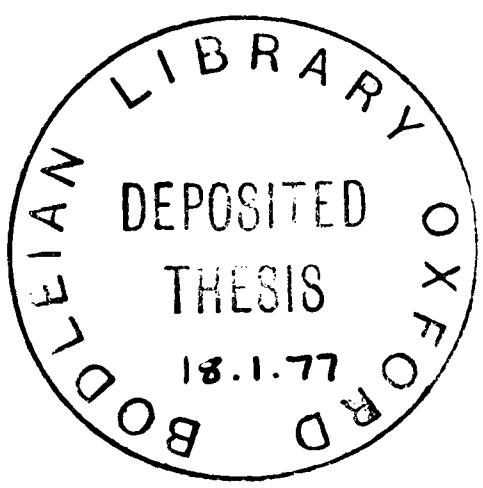
THE MACHINERY QUESTION:

CONCEPTIONS OF TECHNICAL CHANGE IN POLITICAL ECONOMY DURING THE INDUSTRIAL REVOLUTION c.1820 to 1840

BY

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ABSTRACT

The Machinery Question during the early Nineteenth Century was the question of the impact of technical progress on the total economy and society. The question was central to everyday relations between master and workman, but it was also of major theoretical and ideological interest. The very technology at the basis of economy and society was a fundamental platform of challenge and struggle. In the early Nineteenth Century, it was political economy, the 'natural science' of economy and society which took up the theoretical debate on the introduction, diffusion, and social impact of the radically new techniques of production associated with the era. The machine question also came to infuse not only the theoretical realm of political economy, but also the wider culture and consciousness of the bourgeoisie and the working classes. The machine question reflected the close connections of the relations of production to the concerns and conflicts pervading theory, culture and politics.

This thesis has analyzed only one part of this many sided issue. It has focused on the attempt of the middle classes to use the new science of political economy to depict technical progress as a natural and evolutionary phenomenon. However, the thesis also shows that the great variety of theoretical traditions in political economy, combined with significant theoretical and working class dissent with the so called doctrine of political economy prevented the unqualified success of this attempt.

The depth of the controversy evoked over the machinery issue indicated the still marked uncertainty of the experience of industrialization. By the 1820's and 1830's the factory, urban

agglomerations and the coal heaps of mining counties had transformed some parts of the industrial landscape. But the permanence of this change still seemed questionable. Such change was still confined to a very small number of regions, affected small sections of the population, and contributed minimally to national income. The experience of technical change was of great novelty and excitement for those who contemplated the prospects of wealth and power it might bring. On the other hand, for the first generation of factory labour and cast off artisans and domestic workers, it still seemed possible to stop the 'unnatural' progress of technology. Working men and women felt keenly the unprecedented demands for mobility, both geographical and occupational. For them the machine meant, or at least threatened, unemployment, an unemployment which at best was transitional between and within sectors of the economy, and at worst affected the economy as a whole at times of scarce capital. For them the machine was accompanied by a change in the pattern of skills, and involved all too often the introduction of cheap and unskilled labour.

In the period before the 1840's, when labour's great onslaught was against the machine itself, the machine question also featured in middle class doctrine. The times were still uncertain enough to demand that the 'cult of improvement' take on the shape of a cultural offensive rather than mere complacency. Thus the 'cult of improvement' during this era sought its greatest scientific context in political economy. Most of the secondary literature on this period depicts the views of the middle classes and especially of political economy as ones of great pessimism. This thesis shows, to the contrary, that optimism and great faith in the new industrial technology was fundamental to the vision of political economy

and to that of its middle class adherents.

Ricardo's work was an intellectual and doctrinal tour de force which gripped the whole period, but which, in addition, just as significantly generated a great array of criticism. Curiously, the great historical problem of Ricardo's work was the lack of understanding it met, and the serious distortion it suffered at the hands of his popularizers. The great range of Ricardo criticism in the decades after his death was based often on misconceptions of his work. His own Principles which exuded so much interest in and hope for technical progress generated a wealth of dissident literature which also focused on improvement, skill and technical change.

Though the political economy of these years was very diverse, and policy debates were hotly conducted, there is no doubt that the self-defined profession of political economy accepted certain assumptions and outlooks. There were several themes and conceptions which shaped the overall nature of this critique of Ricardo. These themes allow for the demarcation of two epochs of political economy between the 1820's and the 1830's. Political economists of the 1820's placed great emphasis on labour productivity and the skills of the artisan in their attempt to contradict the so called Ricardia predictions of overpopulation and the stationary state. By the 183(economists still found in 'improvement,' technical change, and increasing returns, the great empirical and theoretical rebuttal to the 'Ricardian' predictions. However, 'improvement' was now discussed as the evolution of capital, and even more crucial to thi change was the tendency to see capital as a material embodiment, as fixed capital and machinery.

This shift of concepts was accompanied by a new methodological thrust. The political economy of the 1830's reflected a polemicall; inductivist mood. Unprecedented energy was devoted to debates over abstraction and induction. The political economy which resulted was more empirical, comparative and historical. New interest was given over to visiting factory districts, drawing on government reports, and in using and participating in social surveys. Politic economists devoted more time to comparing the course of economic development in Britain to that of other Western economies, that of primitive societies, and that of previous historical epochs.

The conceptual shift in political economy over these years see to parallel certain tendencies and changes in the economy itself. The political economy of the 1820's appears to reflect the concerns underlying the economic phase defined by Marx as the phase of 'manu factures.' The shift that takes place in theory in the 1830's approximates to the shift in the economy to the phase of 'modern industry.' But the conceptual changes in political economy over the period are also very closely connected to class struggle. This shows in the very seriousness attached by political economists to the 1826 anti-machinery riots in Lancashire and to the 1830 agricultural riots. Discussion of these two disturbances infused the very heights of economic theory. The establishment of politica economy reflected the alarm of the middle classes and provided the 'scientific' answers to the working man's critique of machinery. Moreover, in debate with their critics, they helped to generate a new theory of technical change based on the machine and on the evolution and security of capital and the capitalist. The overall effect of these riots on the middle classes was a celebration of th

cult of technical improvement.

The force of this 'scientific' optimism in political economy was given a deep cultural basis in middle class improvement societies--the Mechanics Institute Movement of the 1820's and the scientific and statistical societies of the 1830's. These movements were attempts to involve both the working classes and the middle classes in a concerted energetic programme to promote technical advance. They also acted to forge new cultural connections between the provinces and the metropolis. A scientific movement which, in its rhetoric at least, focused on the practical, economic and technological connections of science, created a new nexus simultaneously economic and cultural between province and metropolis.

This scientific culture was material and empirical. It was a feature of everyday life that permeated to the technical and managerial manual, dictionary and encyclopedia. The empirical thrust of the scientific movement was a way of involving more people in the great scientific debates. It acted as a democratization of culture within the middle class, and provided a complement to the academic controversy of theory. This empiricist scientific movement was also very congenial to the inductivist mood of political economy in the 1830's.

The scientific movement which promoted fascination with the great prospects of technical progress was closely connected with the political economy of improvement. The study of science and the study of political economy were, for many, integrated pursuits practised in overlapping societies. One area of political economy, the study of the condition of the poor and the working

classes, became the major concern of the social survey, the new method and tool of the statistical movement. The social investigators kept their interests in poverty away from the sensitive areas of the wages and conditions of work. They focused instead on moral problems--education, religion, and providence. Political economy and science were left safely to indulge in the glorification of growth and technical change, while the statistical societies provided the basis of a 'scientific' philanthropy to lull the early Victorian conscience. The problem of the social impact of technical change was thus transferred from an economic question to a moral question.

These intellectual and cultural formulations of the road to improvement were not, as stated above, unchallenged and accepted ideologies. The intellectual vigour and richness of working class culture in the period was just as important in acting to create a fundamental critique and reformulation of the machinery question.

In contrast to the political economists of the middle classes, 'big bottomed spiders, weaving their theoretical cobwebs in comfortable seclusion,'[1] the working classes conceived of their own truly popular political economy--popular in the sense that it was written from the standpoint of the working classes. Middle class science promoted the integration of worker and master in the generation of technical progress, and hoped for a skilled, disciplined and hierarchical labour market. The working class conception of science was a demand not for 'useful knowledge,'

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1. Cited by Raphael Samuel, 'Mayhew and Labour History,' Bulletin for the Society of Labour History, 1973, p. 52

but for 'really useful knowledge.' Science gave them materialist and rationalist explanations of the world which helped to free them from political and religious authority. The very act of learning not only science, but literature, art, and political economy was a claim to culture, to be acquired through 'mutual instruction' in contrast to the 'aristocracy of theory.' While the middle classes worshipped at the altar of improvement and marvelled at the new technology, the working classes resisted the mechanical culture which seemed to bring only degradation. They lamented their fate in verse and petition in ways like the following:

'Mechanics and poor labourers
Are wandering up and down
There is nothing now but poverty
In country and in town;
Machinery and steam power has
The poor man's hopes destroyed,
Then pray behold the numbers of
The suffering unemployed.'[1]

These conflicts in culture and ideology met directly in the political arena of the policy debate. Working men and masters clashed with each other and among themselves in the discussion of the source of Britain's industrial superiority during the policy debate over the repeal of the laws against the emigration of artisans and the exportation of machinery. These debates were crucial in highlighting and generating much more intellectual debate on the role of the capital goods sector and on the ownership of skill. This sector, which contained the possibilities for the manufacture of machines by machines, was the very heart of the development and diffusion of new techniques. The debates also

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1. The Present Condition of British Workmen, n.p., 1834.

projected and fostered a piecemeal and empirical view of technical change which fitted in closely with the scientific movement and the political economy of the time.

A contrast over the debate on the capital goods sector was the controversy over the handloom weavers. Great concern was shown in this period for the mechanization of the 'backward' domestic sectors of the fastest growing consumer industry, the textile industry. This concern was projected most strikingly in the handloom weaver debates, and they were certainly the most widespread of the political debates on technical progress.

The importance of the machinery question reached far beyond the place of production in the 1820's and the 1830's. It featured in the theoretical, cultural and political struggles of these years and as such, was formative to the consciousness of both the bourgeoisie and the working classes.

PREFACE

There have been many thematic studies in the history of economic thought. Most of these studies have, however, been in no sense historical They have generally been studies in the analytical origins of a concept or term. Some historians of economic thought, concentrating on policy, have recognized the historical nature of their project. Few of these, however, have carried their research further than controversy among political economists and politicians at Westminster. The history of economic thought has been an isolated field. It has been both confined to debate within the metropolis, and cut off from the study of contemporary social, cultural and even intellectual change. It has, in effect, been isolated from history.

This thesis poses that the 'Machinery Question' was a controversy integral to social change in early Nineteenth Century Britain. It was not a controversy narrowly confined to the discipline of political economy, but was a concern permeating culture, politics, and the relations between master and workman. The understanding of such a controversy depends on the identification of the connections between its intellectual, social and political dimensions. In other words, it demands a study of the structure of thought. The fulfilment of this task has led me into many fields: the history of economic thought, the history of science and social science, the history of social and economic policy and social history.

I have attempted in this project to construct a materialist history of thought: materialist in the sense that changes in ideas are to be integrated into social and economic change. What I have tried to avoid, however, is vulgar reductionism on the one hand, and apologetic relativism on the other. Conceptual thought cannot be adequately explained by crude

assertions of economic motivation or determinism. The theorist's intent choices, and intellectual horizons do help to explain his ideas. This, alone, is not, however, sufficient. Explanation in terms of a 'linguistic mode' or intellectual context particular to time and place gives relativ ist justification to any idea. Ideas are shaped not only by intellectual context, however wide or narrow. They are also shaped by the role played by the intellectual, in this case, the political economist, by the social problems he is expected to explain or respond to, and by the political forces in debate and controversy. These factors do, in the last analysis rest on social and economic change. But the materialist history can only explain by first making these intellectual and social connections. The 'dominance' of middle class culture in industrializing Britain can only be understood through an attempt to analyze the homology or correspondence of structures in cultural activity. Ideas are a part of history: they are neither isolated from it, nor passively determined by it.

I have learned a great deal and been very stimulated by many friends now doing historical research. I am grateful for their questioning and scholarly attitudes. s

My supervisor, Peter Mathias of All Souls College was enthusiastic, encouraging, and read and criticized my work throughout my research. I would also like to thank the following people who read and criticized parts of my work in various stages: A. W. Coats, Nathan Rosenberg, Ronald Mee M. A. Lebowitz, Ronald Robinson, D. N. Winch, J. R. Hays, and Andrew Gly

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ABBREVIATIONS

B.T.	Board of Trade Papers
P.P.	Parliamentary Papers
P.R.O.	Public Records Office
D. Ricardo, *Works*	*The Works and Correspondence of David Ricardo*, ed. P. Sraffa, Cambridge, 1951

INTRODUCTION

The 'Machinery Question' was the controversy in the early part of the Nineteenth Century over the elements, mechanisms, and impact of technical change. This is not a controversy which has dominated the historiography of early Nineteenth Century Britain. The issue has not taken its place in the history of economic policy alongside the better known issues of the corn laws, factory acts, and poor laws. However, in early Nineteenth Century Britain, in this first experience of industrialization, we do find unprecedented discussion of structural change in an economy. Technical change was, indeed, the major perceived aspect, during this period, of the process of industrialization. The platforms for the diffusion of theories of technical change ranged from eulogies of new technologies, through the propaganda of the scientific movement, to the fears of technological unemployment. The very centrality of technology to perceptions during the first half of the Nineteenth Century is best expressed in the words of Raymond Williams.

> 'Again and again, even by the critics of the society, the excitement of this extraordinary release of man's powers was acknowledged and shared. The society could now have been acceptable to anybody without that. "These are our poems," Carlyle said in 1842, looking at one of the new locomotives, and this element, now so easily overlooked, is central to the whole culture.'[1]

The discussion of the history and prospects of industrialization among middle class ideologues and commentators as well as among those intellectuals with whom they identified was in many ways a continuation of the fascination with 'improvement' among late Eighteenth Century intellectuals. However, by the 1820's, commentators were faced, not merely with the evidence of growth, but with the fact of permanent

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1. Raymond Williams, The Long Revolution, Harmondsworth, 1961, p.88

structural change in the industrial landscape. And yet, the assessment and the aspirations of those carriers of middle class values were curiously ambivalent for most of our period between 1820 and 1840. The ideas of these years very significantly foreshadowed those of the great period of mid Victorian optimism. Equally, the times were scarred with the disappointment of the post Napoleonic depression. Uncertainty marked the response to reconstruction after long years of war. It was, indeed, difficult to predict the outcome of these 'artificial times.' The new industrialism brought great losses, as well as unprecedented benefits. The ultimate direction of the very fragile society of these years of transition was a great unknown.

Crucial to this ambivalence was the machinery and labour issue. This long standing debate over the impact of machinery on employment goes well back into the Eighteenth Century. The early debates took their most vocal form in the response to the late Eighteenth Century jenny riots and the Luddite uprisings of 1811 - 12 and 1816. The issue was also, however of genuine concern throughout my period. In the 1820's and the 1830's, it was the distress and machine breaking of the weavers and the agricultural labourers which attracted most attention. Indeed there were parallel, if not such extreme, responses to mechanization in many more industries. Alternative technologies were also key elements of the utopian and socialist ideology of Robert Owen and his followers, of Thomas Hodgskin and the Ricardian socialists, and of the early Chartists. This working class backlash was just as important as the optimism of a consolidating middle class in making the machinery controversy a major economic issue in middle class circles. Its significance was only highlighted by the fact that the benefits of machinery ranked along with free trade, frugality and population control as a dogma to be instilled into the working classes.

This ambivalence in ideas on industrial expansion in these years means that one must avoid identifying the period, as is done too often, simply with pessimism, Malthusian gloom and the threat of the stationary state. Even more misleading is the view that there was a total lack of contemporary perception of technical advance during this time of rapid industrialization. One must look in a broad way at the discussion of technical change in several overlapping areas. Intellectual discourse in economic theory was one key area. It was not, however, the only area. Even more intense interest in the issue was shown in policy debates. Beyond these two platforms of formal discussion, lies the realm of culture. Popularizations of practical science and technology were very important components of middle class culture. The assumptions lying behind this literature influenced the perspectives of provincial and urban middle class elites. The social meaning of ideas experimented with in all these converging circles can be placed in a framework of a general industrialization debate which connected the concerns of the new industrial areas, and came to set the tone of national debate.

The social interests lying behind politics and ideas in this period have generally been only crudely defined in terms of the landed as opposed to the urban middle classes. This has been endlessly asserted in the history of the corn law debates. The debate over the fate of the agricultural sector, however, had much more complex roots and implications. Methods and relations of production on the land were changing as fundamentally as were those in industry. The image of the threshing machine in Hardy's Tess of the D'Urbervilles, as 'the red tyrant that the women had come to serve ... which ... kept up a despotic demand upon the endurance of their muscles and nerves', is aptly perceived by Raymond Williams as part of a deeper change going beyond the abstractions of industry against rural life.

He argues that the vision of the country must include the 'action of the real threshing machine. It stands in that field and works those hours because it has been hired, not by industrialism but by a farmer. And there are whole human beings trying to keep up with it and with him' [1] The issue of industry and the land was a part of a wider attempt to generalize on the mechanisms of industrialization, to promote the possibilities of agricultural innovation, and to pronounce on the role of science. Ricardian economics, it is true, was very important in solidifying the social interests in the debate over industry versus the land. But there was parallel on-going discussion of Smithian ideas of labour productivity and the self reinforcing effect of the division of labour. This discussion developed over the course of the period into new emphasis on the material aspects of capital formation or 'embodied technical change,' and this was to change again to a fascination with the regeneration of science based growth.

This thesis depicts a general optimism among the early Nineteenth Century middle classes - an optimism far pre-dating the days of the Great Exhibition and the evolutionary theories of the later Nineteenth Century. This optimism, however, was based on a certain bravado. It was a polemical optimism, partly based on ignorance, partly on fear. This shows clearly in the general incomprehension of poverty during the period, in the response to critiques of machinery, and in the cult of comparative growth studies of England, Europe and America. It is notable too, that by the 1830's this optimism was joining a new Victorian middle class conscience for the amelioration of poverty. Optimism and conscience complemented each other in those projects characteristic of the early Victorian middle classes: philanthropy, urban reform, education

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1. Raymond Williams, The Country and the City, St. Albans, 1973, p.256

and moral virtue.

It was to the intellectuals that the middle classes looked for the affirmation of these attitudes. And it was the expositors of the new science of wealth, political economy, who provided the authority and guidance needed by the new industrial elites. This thesis deals with attitudes to industrialization among the middle classes, but focuses specifically on their expression in political economy. It includes consideration of the role of political economy in the guidance of the new elite. Political economy is often left out of our discussion of early Nineteenth Century middle class culture, despite its uncontested position in shaping this culture. The reasons for this are historiographical and I shall return to them below.

Economists, not historians, have turned to the history of economic thought, but they have shown only a narrow fascination with particular theoretical innovations which were either precursors or logically sophisticated alternatives to their own ideas. Practically no historian has given attention to the formative role of political economy in Nineteenth Century ideology. Historians generally have had only some unspecified notion of the significance of political economy in the conduct of politics, in particular in the administration of the liberal tories 1815 to 1830, and in attitudes to the working classes. We are left, however, without any knowledge of the way in which political economy was woven into the successes of Huskisson, Hume, Place, and others. We know little of the peculiar impact of Ricardo, and less of the 'bizarre' popularity of Thomas Chalmers with his potent mixture of Christianity and Malthusianism. We are left lacking a dimension of middle class provincial culture: the role of Smithian economics in late Eighteenth Century radical societies, the pervasive influence of political economy in the formation of the science and statistical societies, and the

economics of working class education.

Even within studies devoted simply to the works of political economy in the period, there lurks the general presupposition that technical change was not considered by the classical economists. Technical change is here defined in the broad sense, so as to include any change in the methods of production which leads to gains in overall returns. As this thesis will make clear, the machinery and labour question was a major contemporary issue of economic policy. Most treatises and many essays of the day on political economy had some comment to make on the issue. Along with this, there was explicit and careful consideration of rising labour productivity, skills, agricultural science, and capital formation, all of which were integral to the on-going process of technical change. It is evident, too, that existing enquiries into Nineteenth Century economic thought have been concerned only with a very narrow range of 'exemplary' classical economists. There has been little serious work on, and a general attitude of dismissal towards a whole range of critics of the great classicals.

This failure to recognize the interest in technical change within political economy springs from the separation of theory from historical issues. The excuse for this has often been that intellectual debate was conducted in a different world, and was isolated from contemporary policy and social problems. However, it is precisely in the traditional texts of high theory in political economy that we find discussions of the export of machinery, the plight of the weavers, working class opposition to machinery, the reform of the poor laws and countless other undeniably political and social issues. The separation of high theory from popularizations and policy must produce distortions in the history of economic thought, particularly in this period. The doctrine of political economy digested by the non-academic was built on the appeal to Smith and Ricardo. Halévy has rightly stressed that Ricardo became the 'representative, the theorist and the orator of a class which was optimistic by

profession - the great English manufacturers, who dreamt of making the economic conquest of the world'.[1] The very inspiration of many of Ricardo's central ideas was his intervention in various policy debates. Furthermore, he and other important contemporary economists, notably Torrens and Senior, partook in the application of their ideas to the solution of contemporary policy problems with their authoritative voices in the House of Commons or in myriad government committees.

Once we admit that political economists were very important members of the middle class elites of their day, and that a major component of the culture of that elite was political economy, we must ask historians to pay attention to the content and use of this economic thought. Economists have rarely been interested in anything other than particular analytical advances in prior economic thought. They have taken a 'whiggish' approach to the history they write. Their models of the Smithian and Ricardian systems have concentrated on only certain elements of these theorists' writing. They have too often missed the point of a theorist's remarks because they are unable to recognize what may have been an intervention in a particular contemporary debate. Such ahistorical interpretation may either neglect the particular point a theorist was attempting to make in devising any particular theory, or ignore the constraints that theorist may have placed on the explanatory abilities of his theory. This is not to say, however, that one must choose externalist over internalist explanation. Rather one must do both. The ideal is to look for explanations which make total historical sense of ideas.

Attention to historical context must then leave the historian with two major decisions: the decision of what texts to read, and the decision of how to interpret these. Economists in the early Nineteenth Century had no institutional definition. But in absense of this, it is wrong to define

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1. Elie Halévy, The Growth of Philosophic Radicalism, London, 1928, p.342

political economy by purely analytical criteria. Too often economists in this period have been defined according to the extent to which they matched the theoretical prowess of Ricardo. More historical definitions should be considered. Some preliminary distinction can be made between those who merely repeated ideas and those who sought to criticize, extend and go beyond these ideas. One can acquire some further idea of contemporary categories by including pieces considered to be political economy by the reviews of the day, as well as pieces read and commented on with interest by political economists dominant both in contemporary terms and in historiography, such as, for example, Ricardo and Senior. There were also a few definite social criteria, such as the new chairs of political economy. The basic definition of the theorist must, in the final analysis, however, be based on some conceptual criteria. Political economy by this time was a discipline. It was a discipline in the sense that some conceptual apparatus and logic of inquiry was widely recognized. Theoretical inquiry, in this sense, went beyond mere opinion. Economists at the time differed widely in their analysis and their methodology - but they did use a common terminology and a common logic of inquiry.

If identification of the significant texts is difficult, interpretation is even more so. Historical context is often given face value recognition by making assertions of influence. However, as Quentin Skinner has shown, this is not only difficult to prove but unhelpful. Others have made crude connections between theory and the movements of the economy or the economic interests of those involved in debate. This reductionism is also tenuous. It is <u>perceptions</u> of reality that are important. From hindsight, we are often able to show that these perceptions were wrong as descriptions of reality. However, it is the perception, not the reality which is of contemporary ideological significance. The most we can say is that a theory reflects the problems thrown up by any economic structure.

We cannot make crude causal connections.

Yet another much used explanatory variable is social conflict. Again, this too sometimes degenerates into crudities, and political economy is seen entirely as apologetics. It is only common sense that we recognize that ideology is more complex than this - the very point of it is the unconscious assumption. Social conflict does, however, have a role to play in defining important middle class concerns, and we cannot deny that issues of social conflict show up in the work of political economy. This is particularly evident in the response to the machinery and labour critiques and Owenism. Such issues take on more depth if we look into the social context of the economists, and the organizations and circles where political economy was significant. There is a definite background of social conflict in the science and statistical societies, in the educational efforts and in the policy programmes of those prominent in political economy. In looking at the role of social conflict, one must pay careful heed to the often indirect mechanisms of its impact. The sociology of cultural movements and policy agitations was one important mediator between ideas and social conflict.

In addition, political context counts as much as does social. Some economic issues were good political tools which gave to the parties which took them up a progressive, reforming stance. What was made of an issue often had more to do with its political sense than its economic content. Political reputations in the early Nineteenth Century were often built and broken on allegiances to any one of a number of explanations of distress. The series of 'crises' punctuating the 1820's and the 1830's allowed ample political manoeuvrings between blaming trade restrictions or overproduction, taxation or the paper currency, overpopulation or machinery and so on.

The policy debates of the time provided the stage for the interaction of all these intellectual, political and social forces. The policy debate

reflected not only conflicting interests, but showed definite constraints on putting these interests across. Theory here played a definite role in defining acceptable types of explanation. Thus one explanation of Brougham's failure to attain distinction as an authority on economic policy might be his recognized inability to master even Smithian economics. The policy debate also, however, has much more adventurous possibilities. For it could provide a forum for tackling problems hitherto unanalyzed by political economy, and was, at the least, a testing ground for existing doctrine. Further, just as often the basic politics of setting up, administering and calling witnesses to a committee inquiry was not an objective scientific investigation of reality, but was, rather, another meeting ground for provincial and metropolitan potentates where doctrine and opinion were embellished and reinforced. The policy debate was a microcosm of the relationships between theory, reality, and social context.

This thesis is an attempt to bring to bear the historical significance of political economy in middle class culture. Consciousness must be derived from the class's sense of itself and of its destiny. I will look at the concrete expression of this outlook in middle class attitudes to and ideas of industrialization. The key idea, in this period, was not merely improvement or growth, but the technical and structural change which influenced the pace and impact of this growth. These attitudes to the components of technical change can tell one of the aspirations and outlook of the class. One can also say something of the expression of these interests in political economy and other intellectual organs, and analyze the way such interests changed between the end of the post Napoleonic depression and the crisis-ridden years of the 1840's. This analysis of an active culture integrated into society allows one to posit some tentative structural connections between economic and social change during the period,

and the conceptualization of technical change. The shift in concepts over the period shows a change from concerns with aspects of labour productivity and the division of labour to reflections on fixed capital formation. This shift in concepts was probably connected, though in a very indirect and diffuse way, to a certain trend of change in the structural basis of the economy. Thus I shall argue that there is a shift in meanings and perceptions from a political economy of what Marx terms 'manufactures' to a political economy of 'modern industry' between the 1820's and the 1830's. Political economists both described these changes and provided the predictions which paved the way for this structural shift in the economy.

The attempt to pose the structural connections between ideas, social context and policy must be done scientifically. I have thus attempted to relate theory to social context and policy by experimentally choosing case studies - the scientific and statistical societies as examples of the social context, and the debates on the export of machinery and the condition of the handloom weavers as studies of the policy connection. The scientific and statistical societies were chosen as significant elite societies bringing together the metropolitan and provincial membership of an activist liberal intelligentsia. The analysis of structure and change within these societies can be seen as case studies of developments in the wider social structure of the period. Similarly, I have chosen two policy debates which individually dominated two different decades of the period, and which reflected different styles of policy agitation. Both debates had parallel followups in new committees in 1839 and 1841 culminating in definitive model reports in 1841. These debates were chosen, too, for the contradictions they presented to prevailing economic doctrine. Free trade dogma was marred by a substantial middle class opposition to the export of capital goods. Equally, we cannot over-emphasize

the impact of the plight of the handloom weavers. This was continually appealed to as a warning among workers in other sectors, and it was always weighing on the conscience of middle class representatives. These debates, beyond all others in the period, brought to bear the full importance of the machinery and labour question, and depicted the ambivalence of the industrializing optimism of the times. The choice of the export of machinery debates and the handloom weaver debates was above all based on their situation as two extremes of the theoretical issues in my discussion of political economy. They are not to be seen as so much representative of contemporary policy debate, as of highlighting the key contrary concerns of the period - the concern with growth and technical change in the capital goods sector, and technological unemployment in the handicraft sector. The significance of these debates lies primarily in the fact that they were extremes, and secondly in the fact that they were very important contemporary issues.

To conclude, this thesis will be developed structurally. A descriptive and analytical presentation of theory will be followed, and in the process enhanced in meaning by an examination of social context, in the concrete form of certain cultural societies. This will be followed by further concretization of ideas and society in an examination of the full operation of these in the formulation of policy in two experimental policy situations. The structure of this thesis follows that of scientific explanation. It proceeds from the abstract to the more concrete which, in turn, takes one back to greater understanding of the abstract.

CHAPTER ONE

Political Economy and Improvement: From Smith to Ricardo

All begins with and returns to Ricardo in the early Nineteenth Century. The novelty and impact of Ricardo's work coincided with what his contemporarie regarded as a new era. This new era, depicted by Carlyle as the 'Age of Machinery', prompted both the middle classes and their social critics to formulate a connection between political economy and industry. This connection, which defined the cultural position of political economy, was also central to the development of ideas in this political economy. The dominance of Ricardo and the paths of his followers and critics owed much to their profound interest in explaining the economic transformation. In the years of the 1820's and 1830's one part of this explanation was sought in the mechanisms and impact of technical change. There is no doubt that Ricardo's analysis was the pivot of this discussion.

It must be pointed out, however, that many of the issues taken up in this period were not entirely new ones. Several central ideas which appear again and again throughout this period were developed in the late Eighteenth Century in the work of Smith and Lauderdale. Certain elements of the contextual framework also appear much earlier. The scientific movement of the 1820's and 1830's has its counterpart in the formation of the literary and philosophical societies in the late Eighteenth Century. The Eighteenth Century, too, was not without its pamphlet literature on machinery riots. There were fairly typical pamphlets such as Thomas Barnes, Thoughts on the Use of Machines in the Cotton Manufacture addressed to the Working People in that Manufacture by a Friend of the Poor, Manchester, 1780,[1] and Anon.,

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1. Thomas Barnes was a Unitarian preacher and lecturer at the Warrington Academy where many of the first Lancashire cotton manufacturers were educated. He was also one of the founders of the Manchester Literary and Philosophical Society.

Letters on the Utility of Employing Machines to Shorten Labour, 1780.[1]

What we see in the 1820's and 1830's, however, are the very clear outlines of the ideological and social strains over the introduction of machinery which dominated the whole of the first Industrial Revolution. The actual profusion of writing on the issue in the first part of the Nineteenth Century as well as the sharpness of the conceptualization illuminate, as Eighteenth Century writing does not, the keen awareness, the confidence and the ambivalence, the struggle and the alternatives in this first transformation of the industrial structure of a nation.

Central issues in the development of technology and its relationship to the dynamic transformation of the economy were discussed long before the 1820's in the work of Smith and Lauderdale in Britain, and J. B. Say in France. I will concentrate here on British ideas since Britain was the first to industrialize. I will, however, discuss Say's work in later chapters as it appeared in the context of debate with the classicals in the 1820's. Smith, on the one side, devised the theory of the division of labour as the growth principle behind rising labour productivity. Lauderdale, on the other, singled out the contributions of fixed capital.

Smith connected the detail division of labour with several factors which contributed to greater productivity of labour. These factors were greater dexterity, economy of time, and the introduction of machinery.[2] Perhaps the most far reaching step Smith took in establishing the connection between these factors and the division of labour was to show that the division of labour was self reinforcing. A class of machine makers, the regeneration of skill, and an intimate connection with an expanding market

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1. This pamphlet is noted by Lord Lauderdale, An Inquiry into the Nature and Origin of Public Wealth, Edinburgh, 1804, p.298
2. Adam Smith, An Inquiry into the Nature and Causes of the Wealth of Nations, (1776), London, 1904, i, chapter 1.

were the vital dynamic links resulting from the division of labour.[1] This conceptualization of the market and technical differentiation brought with it changes in the meaning of the word skill. Skill, once identified with an 'art' or craft became in Smith's hands a 'peculiar dexterity' which resulted from the division of labour and the breakdown of a craft.[2] Smith also identified the division of labour as the material basis for a separation between mental and manual labour. The leisure allowed some classes by the division of labour gave to those classes the time and the cultural scope necessary to scientific discovery. The social hierarchies based on the division of labour which gave rise to the divide between the labourer and the natural philosopher also allowed Smith to account for further separations, as between the machine maker and the machine minder.[3]

Smith established the equally important dynamic interaction of the accumulation of capital and technical progress.

> 'As the division of labour advances, therefore, in order to give constant employment to an equal number of workmen, an equal stock of provisions, and a greater stock of materials and tools than what would have been necessary in a ruder state of things, must be accumulated beforehand.'[4]

The connection Smith established between capital accumulation and technical change allowed him to ignore labour displacement.

> 'But the number of workmen in every branch of business generally increases with the division of labour in that branch; or rather it is the increase of their number which enables them to class and subdivide themselves in this manner.'[5]

Machinery did not displace labour. Rather it differentiated this labour by dismembering the old craft.

Lauderdale posed the process of technical change somewhat differently.

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1. Adam Smith, An Inquiry into the Nature and Causes of the Wealth of Nations, (1776), London, 1904, i, chapters 2, 3, 10.
2. Ibid., i, pp.9 and 139
3. ibid., i, 12
4. ibid., i, 302
5. ibid., i, 302

Where Smith envisaged the expansion of employment in the process of capital formation and the division of labour, Lauderdale argued that the introduction of machinery was purely a labour saving device. He referred to the stocking knitters and the new machine looms. 'The profit of stock employed in machinery is paid out of a fund that would otherwise be destined to pay the wages of the labour it supplants.'[1] Lauderdale, furthermore, related the impact of labour saving machinery to the social conflict of his own time.

> 'It derives ample testimony of its truth from the conduct of the unlettered manufacturers themselves, as is sufficiently evinced by the riots that have taken place on the introduction of various pieces of machinery, and particularly at the time when the ingenious machines for carding and spinning were first set a-going.'[2]

Smith did not refer to such social conflict, but he did show concern for the mental and cultural degeneration produced among the lower classes by the division of labour.

Both Smith and Lauderdale, moreover, were worried about the connections between this degeneration and the inventive capacity of a nation. Both argued that the division of labour could have a stultifying effect on ingenuity. Smith identified barbarous societies with varied occupation.

> Invention is kept alive, and the mind is not suffered to fall into that drowsy stupidity, which, in civilized society, seems to benumb the understanding of almost all the inferior ranks of people.'[3]

Lauderdale, too, believed there was a logical gap between the division of labour and the type of conceptualization necessary to the invention of machinery. The principle behind the invention of machinery was to combine and embrace within one machine the execution of the greatest possible variety of operations in the formation of a commodity. But the division of labour was destructive of

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1. Lord Lauderdale, An Inquiry, p.167
2. ibid., p.171
3. Adam Smith, Wealth of Nations, ii, p.418

the chain of reasoning necessary to the perfection of machinery.[1]

These early ideas on the machinery question became continuous themes in an emerging discipline of political economy. After the end of the Eighteenth Century, political economy became separated from moral and political philosophy. The following section will seek the emergence of this new strand and describe the institutional complexity it had acquired by the time of Ricardo.

The period between Smith and Ricardo has been singled out by Halevy for the fact that not one single complete treatise on political economy appeared in England. He argues that without the knowledge or the assistance of the legislature a new industrial world had arisen. The transformation brought with it a whole series of problems leading to those parliamentary inquiries which culminated, in the theoretical sphere, in the theory of rent.[2] But the ascendancy of Ricardo was not such a simple process. Neither was the period before his influence empty of economic controversy. Ricardo formulated his ideas in confrontation with the legacy of an ideology of physiocracy and agricultural expansion. The underconsumptionist theory of a gentry economics was a decided adversary to those carriers of Smithian economics who identified with the new industrial capitalism.[3] It is correct to depict the struggle in economics during this period as representative of that between the land and industry, though certainly this bold demarcation must be subject to many qualifications. Among those ranked on either side of this theoretical divide there were great differences in assumptions and allegiances.

Differing schools of thought in these years were fundamentally premissed

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1. Lord Lauderdale, An Inquiry, pp.294 - 295
2. Elie Halévy, The Growth of Philosophic Radicalism, pp. 265 and 277
3. See Ronald Meek, 'Physiocracy and Classicism in Britain,' Economic Journal lxi, March, 1951, pp.332 - 344. See James Mill, Selected Economic Writings, ed. D. Winch, Edinburgh, 1966, pp.23 - 38

on differences in politics. G. S. L. Tucker has aptly formulated the connections of Nineteenth Century theories of profit to practical questions of economic policy. The intellectual interest in explaining a secular decline in the earnings of capital was a feeble incentive beside the desire to account for the facts of contemporary experience, and to give some guidance to economic policy in wartime and post war Britain. The corn laws, the national debt, taxation, foreign investment and colonial development, the introduction of machinery, financial crises and trade fluctuations, were all problems requiring some analysis of the direction of profits.[1]

Indeed, theoretical controversy often involved political controversy, particularly between the whigs and the tories. The period 1815 to 1830 was dominated by the tory ministries, all of which took on the policy prescriptions of the classical economists. As A. J. B. Hilton has put it, these governments 'broke with physiocracy, autarchy and agricultural expansion.'[2] They dismissed the benefit of public works and denied the permanent effects of a post war glut. The alliance of toryism and classical economics was, however, countered by a definite political economy of opposition. The whigs were left to maintain a radical under-consumptionist theory. Policy prescriptions involved public works, public spending and tax reduction. This was an activist policy founded on that basic fear of Malthus - that demand might not keep up with production.

This setting of theory and policy was complemented by a definite institutional setting for political economy. Ricardo's rise to predominance

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1. G. S. L. Tucker, Progress and Profits in British Economic Thought 1650 - 1850, Cambridge, 1960, pp.158
2. A. J. B. Hilton, 'The Economic Policy of the Tory Governments 1815 - 1830', (D. Phil. Thesis, Oxford, 1973), Abstract. Also see B. Semmel, ed., Occasional Papers of T. R. Malthus, New York, 1963, pp.20 - 29

was helped by this institutional framework. Just as significantly, however, his great prestige changed the character of these institutions.

Political economy had many voices during this period, and its institutions - the clubs, journals, and newspapers which helped give definition to the discipline - were not simply avenues for dogma. The Political Economy Club was the most prestigious of these forums. Mallet's diary of the Club's proceedings during this period bears eloquent testimony to the great diversity of interests within the Club.[1] The Club, founded by Tooke and the originators of the Merchant's Petition of 1820 had a practical and not a sectarian character.

A plethora of literary reviews also encompassed political economy in their subject matter. Political economy was popular in both the Edinburgh and the Westminster Reviews. Both, however, practised exclusion of heretical views on political economy at some time.[2] Wide ranging criticism of Ricardian views was kept up by the Quarterly Review, the British Critic, Blackwoods and the Monthly Review. Theoretical debate was even conducted in the newspapers - particularly in the Morning Chronicle, and Torrens' papers, the Globe and Traveller and the Champion.[3]

The philosophic radicals did attempt to attach Ricardian political economy to their own political doctrines. They attempted this unsuccessfully in the Political Economy Club,[4] and also nurtured liberal debating

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1. See Political Economy Club, vi, 1921, xi - xiii, 2 - 3, 212
2. For more discussion of these journals see John Clive, The Scotch Reviewers: The Edinburgh Review, 1802 - 1815, London 1957; and G. L. Nesbitt, Benthamite Reviewing: The First Twelve Years of the Westminster Review 1824 - 1836, New York, 1934.
3. B. J. Gordon, 'Criticism of the Ricardian Views on Value and Distribution in the British Periodicals, 1820 to 1850', History of Political Economy, i, Fall 1969; and his 'Says Law, Effective Demand, and the British Periodicals, 1820 to 1850', Economica, 32, Nov. 1965. Also see Frank Fetter, 'Robert Torrens: Colonel of Marines and Political Economist', Economica, 29, May, 1962. On the Champion see Ricardo, Works, ix, 114n.
4. James Mill, Selected Economic Writings, pp.192 - 193

teams for the London Debating Society and the London Co-operative Society.[1] James Mill, in addition, took on the role of shaping Ricardo into a parliamentary spokesman for the Benthamite cause.[2] Ricardo himself professed pleasure in the diffusion and popularization of his ideas.[3]

It was not the Mills, but McCulloch, who was to give the widest platform to Ricardo's ideas. His review of Ricardo's Principles in the Edinburgh Review of 1818[4] was decisive in popularizing Ricardo's new economics. His subsequent work in the Edinburgh Review and the Encyclopedia Britannica, along with his own Political Economy and his edition of the Wealth of Nations helped to spread Ricardo's doctrines, and also infused McCulloch's own wide ranging teaching with intellectual respectability. McCulloch, in his Rise and Progress of Political Economy, established an interesting connection between the rise of political economy as a science and the rise of capitalist relations and attitudes. In his determinist history of economic thought he accounted for the late emergence of political economy by the fact that the ancient world was a slave economy. There could be no political economy as long as market relationships between landlords and tenants, or masters and servants were unknown, and as long as there was prejudice against the accumulation of wealth, commerce and industry.[5]

The impact of Ricardo's work also raised latent controversy on abstraction and induction; and on the theoretical or practical nature

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1. J. S. Mill, Autobiography, pp.126 - 127
2. James Mill Selected Economic Writings, p.179. See, for example, Mill's advice on reading to Ricardo in his letters to Ricardo, 19 Oct. 1817 and 3 Dec., 1817, Letters 1816 - 1818, Works, ed. P. Sraffa, vii, 197, 211 - 212
3. Letters 1821 - 1823, Works, ed. P. Sraffa, ix, Ricardo to Trower, 11 Dec. 1821 and Ricardo to Mill, 10 Dec. 1821, 118 and 122
4. See D. P. O'Brien, J. R. McCulloch, A Study in Classical Economics, London, 1970, pp.18 - 20
5. J. R. McCulloch, A Discourse on the Rise, Progress of Political Economy, Edinburgh, 1824, pp.3 - 8

of the discipline of economics. Many of his contemporaries were also clearly worried about the extent of controversy, both methodological and theoretical in their emerging discipline. McCulloch was very worried about 'recent great differences among its most eminent professors'.[1] And Malthus felt that

> 'An agreement among the principal writers in Political Economy is very desirable with a view to the authority of the science in its practical application.'[2]

We can see, therefore, that Ricardo was intervening in a debate which ranged over the very foundations of political economy. The next chapter will seek to define Ricardo's ideas against the background of this controversy.

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1. J. R. McCulloch, Rise and Progress of Political Economy, p.8
2. T. R. Malthus, Principles of Political Economy, Works of Ricardo, ed. P. Sraffa, ii, 5.

CHAPTER TWO

Ricardo on Technology

The theoretical and institutional diversity of political economy during the years of Ricardo's greatest influence provide a suitable setting for the description of Ricardo's own ideas. This setting gives us greater understanding of Ricardo's struggle to formulate his ideas and to distinguish his own position from those of his critics and imitators. This chapter is a textual analysis of Ricardo's conceptions of technical change. The chapters which follow examine the ideas of his critics and supporters in the 1820's and 1830's.

It is first important to reassert the intellectual affinity between Smith and Ricardo. This is not, however, to assert either influence or a homogeneous classical model, for this can neither be proved nor tell us anything particularly interesting.[1] Ricardo, like virtually all his contemporaries in political economy came to the subject through the study of the Wealth of Nations. The structure of his own Principles bears this out. In the Principles, the chapters on political economy were followed first by the chapters on taxation and finally by the polemical chapters. This was very close to the layout of the Wealth of Nations.[2] The views which Ricardo expressed within these chapters of the Principles were worked out in dialogue with Smith. The theories set out in the earlier chapters of value, rent, wages and profit are carefully posed to contrast with those of Smith.

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1. See Quentin Skinner, 'The Limits of Historical Explanation', Philosophy, July, 1966 for an explanation of logical inadequacies in assertions of influence. Furthermore, those who assert the influence of Smith on Ricardo say only the obvious. They must also distinguish between real influence and rhetorical device in Ricardo's references to Smith.
2. See P. Sraffa, 'Introduction', The Works and Correspondence of David Ricardo, ed. P. Sraffa and M. Dobb, i, Cambridge, 1951, xxiv - xxv

Similarly, Ricardo's work was publicly received with reference to the Smithian tradition. McCulloch, for instance, reported in 1818 that Ricardo had no real converts in Edinburgh because in Smith's stronghold it was 'reckoned treason' that he doubted his doctrines.[1] Sometime later, Malthus wrote that though Ricardo had captivated some, his views were 'not spread very much among the great body of political Economists' They would not 'stand the tests of examination and experience',[2] the perceived criteria of Smithian methodology.

To assess how far Ricardo departed from the Smithian tradition in his attention to technical progress, we must use the whole of his work. This allows the reconstitution not only of the structure of his basic theory, but of his policy stands and his commentary on experience. In doing this, we follow the spirit of the structure of his Principles and have some means of assessing where he was making a point or an intervention in a dialogue.[3] In this chapter I will follow through Ricardo's discussion of technical change and improvement with reference to his theory of value, to the distribution of income, and to the mechanisms of production and growth. My task here is not to assess this in terms of an abstract model.[4] This would be only a very small part of the problem. Rather, the point of this chapter will be to draw closer attention to Ricardo's own remarks on the issue, remarks not only on the impact of technical change, but also on its sources and mechanisms. The formal result would involve a series of models, not one. The task of this chapter, however, is only one of the

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1. Letters 1816 - 1818, Works of Ricardo, ed. P. Sraffa, vii, J. R. McCulloch to Ricardo, 3rd Sept., 1818, p.295
2. Letters 1819 - 1821, Works, viii, T. R. Malthus to J. C. L. Simonde de Sismondi, 12 March, 1821, 376
3. For discussion of theory, intention, and language see Q. Skinner, 'On Political Thought and Action', Political Theory, ii, Aug. 1974
4. For a standard treatment of the Ricardian model see D. P. O'Brien, Classical Economics, pp.39 - 41

identification of these remarks, the location of their intellectual context and the assessment of their significance.

Value

Value was the matrix of Ricardo's novel conception of economy and society. The concept of value united the technical processes of production with the exchange of commodities and with the distribution of income.

Technology played a very prominent part in the whole of Ricardo's value theory. The actual technical structure of an economy, its capital labour components and the technical composition of its capital were factors which influenced value. Ricardo, moreover, appears to have flirted with a 'historical' view of the value problem - one which looked at the causes of value in terms of the different stages of society.

Ricardo's concept of exchange value first appeared in the Essay on Profits of 1815. Here, Ricardo explained value by the difficulty of producing food.[1] The technology of producing basic commodities was the source of value. Ricardo's discussion of value in this early period leading to the first edition of his Principles was strikingly close to his analysis in the third edition. The only real change over this period was Ricardo's presentation or exposition of the theory.[2]

The debate among the Ricardo commentators now is still concerned with the question of whether Ricardo had a cost of production theory or a labour theory, but there is no longer any question over whether there was any transition in his position. Stigler, on the one hand, separates out analytical and empirical strands in Ricardo's value theory, and asserts

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1. David Ricardo, An Essay on the Influence of a Low Price of Corn on the Profits of Stock, London, 1815, in Pamphlets and Papers, 1815 - 1823, Works, ed. P. Sraffa, iv, 20 - 40
2. Sraffa has convincingly shown that there was no retreat in Ricardo's theory of value between the first and the third editions. P. Sraffa, 'Introduction', Works, ed. P. Sraffa, i, xxx - xlix

an analytical cost of production theory counteracted by an empirical theory posing labour as the most significant of the factors quantitatively. Sraffa has reasserted the labour theory behind Ricardo's interest in value, and has explained the interest in departures from this in terms of the search for an invariable measure of value. Sraffa's own interest in the measurement of capital and the influence of distribution on prices has coloured his interpretation of Ricardo. Ricardo is depicted as one preoccupied with the puzzle that the size of national product appeared to change when the division of it between classes changed. The problem of value theory, in Sraffa's view, was the need for a measure of value invariant to changes in the division of the product.[1]

Both of these interpretations of Ricardo appear to be rather far removed from Ricardo's polemical points and his dialogue with his critics. Some attention to the discussion of the technological structure of economies and the bearing of this on value may perhaps throw light on the problem.

The first problem to be dealt with is the relative significance of Ricardo's 'historical' concept of value.[2] Where the production process was entirely constituted of labour, value was determined only by relative amounts of labour time. Historical change, however, brought new techniques of production composed not only of labour but of varying amounts and types of capital. Value thus appeared to be determined not only by labour time but by capital. Ricardo did have some notion of a primitive society where,

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1. P. Sraffa, 'Introduction', i, p.xlvii
2. The idea that there was a historical conception of the labour theory of value which ran right through Smith, Ricardo and Marx was first put forward by Ronald Meek, in Studies in the Labour Theory of Value, London, 1956. This type of analysis has recently been strongly criticized with special reference to Marx in G. Catephores and Morishima, 'Is there an "Historical Transformation Problem"?', Economic Journal, lxxxv, June, 1975.

unlike contemporary Britain, commodities exchanged at their labour values. In the first edition of the Principles he wrote,

> 'It appears then that the accumulation of capital, by occasioning different proportions of fixed and circulating capital to be employed in different trades, and by giving different degrees of durability to such fixed capital, introduces a considerable modification to the rule, which is of universal application in the early states of society.'[1]

This was reinforced in the second and third editions,

> 'It will be seen, then, that in the early stages of society, before much machinery or durable fixed capital is used, the commodities produced by equal capitals will be nearly of equal value, and will rise or fall relatively to each other only on account of more or less labour being required for their production; ...'[2]

However, Ricardo, just as strongly dissociated himself from a theory of value which changed with historical circumstances. Contrary to Smith, he sought a single theory of value valid to all stages of society. Ricardo criticized Smith for limiting his theory of value to 'that early and rude state of society, which precedes both the accumulation of stock, and the appropriation of land'.[3] Throughout the chapter on value and the Notes on Malthus, Ricardo also argued that those factors affecting the technical composition of production and causing departures from the labour theory of value operated in all stages of history.[4] It seems that Ricardo was very assertive of the need for a theory of value common to all countries and periods of time. Such a theory, he clearly recognized, would have to allow for certain exceptions which could be explained by the technical conditions of production in the particular economy.

It is difficult to reconcile this analytical value theory with Ricardo's

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1. David Ricardo, On the Principles of Political Economy and Taxation, ed. P. Sraffa, The Works and Correspondence of David Ricardo, Cambridge, 1951, i, 66
2. ibid., pp.62 and 43
3. ibid., p.23
4. For examples, see D. Ricardo, Principles, pp.24 and 33, and Notes on Malthus, ed. P. Sraffa, Works, ii, p.39

historical allusions to a primitive pure labour theory state. But we cannot dismiss this historical dimension as simply another form of expression of the analytical theory. Ricardo quite clearly distinguished his allusions to the primitive state from his analytical divisions which were commonly expressed in such a way as the following,

> 'If men employed no machinery in production but labour only, and were all the same length of time before they brought their commodities to market, the exchangeable value of their goods would be precisely in proportion to the quantity of labour employed.'[1]

Furthermore, Ricardo's historical terminology bears close relationship to Smith's. The configuration of transition from primitive to progressive states was not a logical tool but a part of Smith's theory of history. Ricardo's theory of value too is expressed in terms of a hunting and barter economy based on the Eighteenth Century image of the North American Indian. Whether or not he really believed in the mythical pure labour theory state, it is certain that Ricardo's theory of value did not lack historical dimensions. The theory of value extended to all stages of society, but the extent to which the pure labour theory could be applied depended on technical conditions of production. Ricardo, too, envisaged differing social conditions of production, but unlike Smith, he argued that these social conditions would be expressed in the distribution of the product, and this distribution would not affect value. As Ricardo expressed it,

> 'All the implements necessary to kill the beaver and deer might belong to one class of men, and the labour employed in their destruction might be furnished by another class; still their comparative prices might be in proportion to the actual labour bestowed, both on the formation of the capital and on the destruction of the animals'.[2]

It was because Ricardo's theory did carry over a historical

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1. D. Ricardo, Principles, p.32
2. ibid., p.24

sensitivity, that it was able to encompass the exceptions posed by the introduction of capital.

From the time of his first edition through until his death, Ricardo emphasized the modifications to the rule that commodities exchanged according to the labour embodied in them. His critics constantly misinterpreted him as believing in an extreme labour theory of value. A typical reply was that to Malthus in 1820,

> 'I have myself stated that in proportion as fixed capital was used; as that fixed capital was of durable character and in proportion to the time which must elapse before commodities can be brought to market, the general principle of the value of commodities being regulated by the quantity of labour necessary to their production, was modified; but I was of opinion and still am of opinion, that in the relative variations of commodities, any other cause, but that of the quantity of labour required for production, was comparatively of very slight effect.'[1]

The modifications posed by the introduction of capital in different proportions and technical composition were all conceptually time modifications.

It is important to bear in mind that the significance Ricardo attached to the modifications to his theory was often dependent on the rhetorical situation. In the passage above, he was addressing himself to Malthus, one of his primary critics. He expressed himself similarly to Torrens, another critic who proposed a capital theory of value.[2] Ricardo, however, gave greater attention to the modifications when he was correcting the crude theories of value of his own supporters, J. R. McCulloch and James and John Stuart Mill. He accused the Mills and McCulloch of going to extremes in admitting no exceptions or qualifications to the labour theory of value. The attempts by both McCulloch and J. S. Mill to give anthropomorphic definition to machinery and capital, and to define profits as wages left

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1. David Ricardo, Notes on Malthus, p.59
2. David Ricardo, 'Fragments on Torrens concerning Value', 1818, Pamphlets and Papers 1815 - 1823, Works, iv, pp.316 - 318

him particularly unimpressed.[1] It is also with this polemical sense in mind that we must see Ricardo's statement to McCulloch in 1820, which appears to be contradictory to his statement to Malthus in the same year. Here Ricardo wrote,

> 'I sometimes think that if I were to write the chapter on value again which is in my book, I should acknowledge that the relative value of commodities was regulated by two causes instead of by one, namely, by the relative quantity of labour necessary to produce the commodities in question, and by the rate of profit for the time that capital remained dormant, and until the commodities were brought to market.'[2]

All that we can establish with any certainty is that Ricardo did have a modified version of a theory of value determined by labour time. The significance he attached to these modifications seems to have varied according to his audience. His major point, however, was to distinguish an explanation of price based on the cost of production from one based on the returns from production. Ricardo may have had an interest in protecting his labour theory of value from collapsing into a cost of production theory. It is certain, however, he had a prior interest in establishing the material basis of value in the actual sacrifice of direct and indirect labour within the production process. Here again, his dialogue was with Smith,

> 'It is not by the absolute quantity of produce obtained by either class, that we can correctly judge of the rate of profit, rent and wages, but by the quantity of labour required to obtain that produce.'[3]

Ricardo specifically denied the significant impact of distribution on price. However, it was in the polemic with Smith over the connection

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1. Letters 1821 - 1823, Works, ix, D. Ricardo to J. R. McCulloch, 15 August, 1823, p.357. Ricardo to James Mill, 5 Sept., 1823, p.387
2. Letters 1819 - 1821, Works, viii, Ricardo to McCulloch, 13 June, 1820, p.194
3. Ricardo, Principles, (1st edition), ed. P. Sraffa, Works, i, p.64 See also Ricardo, Principles, p.117

of rising wages to rising prices, that Ricardo discovered that distribution might indeed have some impact, but in a completely unexpected way. Smith had argued that in a commercial society, value was influenced not only by labour, but by rent and profits. He argued that a rise in wages, rents or profits would lead to a rise in value.[1] Ricardo made great efforts to show that a change in the distribution of the product, or more specifically, that a rise in wages, would not affect value. In doing so, he went even further, and showed that a rise in wages could even have an effect completely converse to Smith's expectations. A rise in wages reduced the relative value of those commodities produced by capital intensive techniques. Thus Ricardo came to admit the impact of distribution on price, but within a polemical framework which was intended to deny that effect.[2]

The modified labour theory did pose a convenient way of measuring the impact of technical change. Because value was a function of the difficulty of production, any form of technical change acted to reduce value, and this reduction in value was measured by the labour saved. But again, technical change did not have any definite influence on distribution. Ricardo now required some standard by which to measure any variation that took place in distribution during the course of technical change.

> 'By improvements in machinery and agriculture, the whole produce may be doubled;..But if wages partook not of the whole of this increase, if they, instead of being doubled, were only increased three-fourths, and the

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1. Adam Smith, The Wealth of Nations, i, chap. 6
2. Thus his attempt to keep the significance of this contradictory effect small.
   > 'The greatest effects which could be produced on the relative prices of these goods from a rise of wages, could not exceed 6 or 7 per cent; for profits could not probably under any circumstances admit of a greater general and permanent depression than to that amount.'
   > (Principles, p.36)
   Also see Principles, pp.26 and 36

> remaining increase went to profits, it would, I apprehend, be correct for me to say, that rent and wages had fallen, while profits had risen; for if we had an invariable standard, by which to measure the value of this produce, we should find that a less value had fallen to the class of labourers and landlords, and a greater to the class of capitalists, than had been given before.'[1]

Ricardo quite clearly stated his reasons for continuing to search for a standard of value over the whole period from 1817 to 1823. His primary interest was to identify the source of variation behind a change in relative exchange value between two commodities. Was a new exchange value due to changed production conditions in one commodity, or in the other, or in both?[2] A standard of value would also allow for a quantitative assessment of a commodity's change in value over time.[3] Ricardo saw the standard of value as a necessary tool or numeraire for comparison. It was within this problematic that he also took into account the difficulty of changes in the numeraire itself.

However, Ricardo's primary search was for some criterion for identifying the source of a real change in value. The problem was both one of a change of value between two commodities, and one of a change in value between the measure itself and the commodity. The curious impact of a change in wages followed as a secondary effect.[4] Ricardo, in fact, finally settled on gold as his approximate standard - a commodity which represented a mean in general production conditions.[5] Ricardo, however, saw the limitations of his very approximate standard, while conceding that a perfect measure was impossible. He, therefore, still referred to the need

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1. Ricardo, Principles, (1st edition), p.64
2. Ricardo, Principles, p.17 and 'Absolute Value and Exchangeable Value', 1823, Pamphlets and Papers 1815 - 1823, Works, ed. P. Sraffa, iv, 400 - 401
3. ibid., 381
4. Note the context in which Ricardo raises the difficulty of changes in the measure. See Principles, (1st edition), p.64
5. Ricardo, 'Absolute and Exchangeable Value', p.389. See Sraffa, 'Introduction', p.xliv for a discussion of the process by which Ricardo arrived at his standard in the period 1817 to 1823.

to have something by which to measure variations in the standard itself.[1] It is by studying the historical order in which Ricardo came to confront the various problems that culminated in his modified labour theory of value that we come to understand the purpose of his concern to have a standard of value. The standard was not merely to act as a reference point for quantifying the relations between value and distribution. The standard was also to aid in measuring changes in value over time. The major source of these diachronic changes in necessary labour time were technical change on the one hand or higher production costs on the other.

Value was, however, inextricably linked to the analysis of distribution, since Ricardo spoke of changes in income distribution in terms of changing value proportions between the various income shares.[2] As Dobb has clarified, when Ricardo spoke of these shares as rising or falling, he meant rising or falling in real value or in the quantity of labour required to produce the crucial wage share.[3] The impact of diminishing returns was also described in terms of its impact on total value. As total product increased, value also rose, not only by the increase in the quantity produced, 'but by the new value which is given to the whole produce of the land, by the increased difficulty of producing the last portion of it'.[4] Pure capital accumulation without either trade or technical change resulted both in rising rent

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1. 'Absolute and Exchangeable Value', p.397. Ronald Meek in 1955 drew attention to this underlying notion of value. The perfect measure would be a sieve which meshed out all the effects produced by a change in wages and retained only those produced by a change in the quantity of embodied labour.
   See Ronald Meek, Studies in the Labour Theory of Value, pp.112 and 119
2. See D. P. O'Brien, Classical Economics, pp.89 - 90 for these connections in Ricardo's model. Ricardo chose gold with a production period of one year as his standard. This was the same as the period of production in his corn model. Thus the theory of value was integral to the corn model.
3. Maurice Dobb, Theories of Value and Distribution Since Adam Smith, Cambridge, 1973, p.85
4. Ricardo, Principles, p.124

shares, and in overall increases in total value. Thus Ricardo identified the interests of the landlord,

> 'it is obvious that the landlord is doubly benefited by the difficulty of production. First he obtains a greater share, secondly the commodity in which he is paid is of greater value'.[1]

Just as the impact of technical change could be quantified in terms of the extent to which it reduced value, so technical change was also very important to relative income shares. It was the distribution of income between profits and other shares which determined the rate of accumulation. Ricardo assumed that all accumulation was derived from profits. Any technical change which contributed towards offsetting diminishing returns raised profit shares and, therefore, the rate of accumulation.

Distribution

The received view of Ricardo's theory of distribution is that it was entirely based on an assumption of constant knowledge. G. S. L. Tucker, for instance, has argued that the effects of improvements were only introduced as modifications at the end of an analytical process. He tries to prove that in the Ricardian analysis, technical change only acted indirectly by affecting wage shares. He furthermore maintains that Ricardo dealt with an economy with no capital saving innovations and no improvements in technical knowledge.[2] In addition, Pasinetti has argued that the law of diminishing returns was not necessary either to the theory of population or to Ricardian rent theory. He tries to prove this by showing that Malthus had developed his theory of population without reference to diminishing returns, and that the differential theory of rent had already been anticipated in 1777 by James Anderson. In Pasinetti's view, the law

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1. Ricardo, Principles, p.83
2. G. S. L. Tucker, Progress and Profits in British Economic Thought 1650 to 1850, pp.96 - 97

of diminishing returns was purely an analytical tool making Malthus' principle of population and Ricardo's gloomy view of capitalist development impregnable to criticism.[1]

This section will show that Tucker's interpretation of the point of Ricardo's model is a very extreme one, and that it is simply wrong to identify the main body of Ricardo's theory with a lack of conceptualization of capital saving innovation and improvements in technical knowledge. It is also wrong to identify Ricardo's use of the law of diminishing returns with an attempt to prevent criticism of his theory. The origins of the theory of rent in the pamphlets of 1814 to 1815 by West, Malthus, Ricardo and Torrens were centred on the law of diminishing returns. It may be that some of these had read Anderson, though Tucker provides no such evidence.[2] Even if they had, however, the operative theory of rent in the period was one connected to diminishing returns, and precursors were irrelevant to the contemporary debate.

The case I wish to make here is that the model of distribution outlined by Ricardo was neither his total conception of economic reality, nor did it reflect his major interests. The model was a very circumscribed one. Ricardo's major interests were concentrated on the sources of accumulation. He made a positive stand that technical change and the gains from trade constituted major possibilities for raising the rate of accumulation. In order to show the quantitative impact of these factors

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1. L. Pasinetti, 'From Classical to Keynesian Dynamics', Growth and Income Distribution, ed. L. Pasinetti, Cambridge, 1974.
2. James Anderson was the author of a longwinded critique of Adam Smith's analysis of corn prices. Smith's own reaction to the critique was fairly dismissive. He merely admitted that he had expressed himself clumsily and condescended to alter a sentence. See Letter from Smith to Andrew Holt, Commissioner of the Danish Board of Trade and Economy n.d. (c. October, 1780), in W. R. Scott, Adam Smith as Student and Professor, New York, 1965, Letter No. 47, pp.281 - 284

on accumulation, Ricardo set up a model which initially abstracted from their effects. This was his model of 'natural tendencies'.

> 'The natural tendency of profits then is to fall. This tendency, this gravitation as it were of profits, is happily checked at repeated intervals by the improvements in machinery, connected with the production of necessaries, as well as by discoveries in the science of agriculture which enable us to relinquish a portion of labour before required, and therefore, to lower the price of the prime necessary of the labourer.'[1]

Ricardo constantly contrasted the laws of nature with social and economic change. This is borne out with even greater force in the basic outlines of his theory as set out in his Essay on Profits of 1815. Here he conceived of two natural situations: one where land was unlimited, and another where it was limited. He set out to discover possible ways of moving from the latter natural state towards the former - that is, in extending the limits of land. Ricardo specifically stated in this essay that he was setting up a model of the process of economic change in a situation of limited land. His model was explicitly a closed economy model so that the constraints imposed by limited land could not be escaped by international trade. This model was also based on the assumptions of no agricultural improvements and of capital and population rising in the same proportions, so that real wages stayed the same. But, he added, the point of this was to allow 'the separation out of effects ascribed to the growth of capital, the rise of population, and the extension of population to less fertile land.'[2] Ricardo then went on in the Essay to examine the effects of each of these factors.

Both Mark Blaug and Maurice Dobb have argued that the significance of this model of distribution is only to be understood in the context of the debate on the Corn Laws. Blaug has pointed out that hindrances to

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1. Ricardo, Principles, p. 120
2. Ricardo, An Essay on the Influence of a Low Price of Corn on the Profits of Stock, p. 12

foreign trade were conditions behind the tendency of the falling rate of profit. The stationary state was 'a methodological fiction'.

> 'the alleged "pessimism" of Ricardo was entirely contingent upon the maintenance of the tariff on raw produce ... the notion of an impending stationary state was at most a useful devise for frightening the friends of protection'.[1]

Dobb has, more recently, brought added attention to the importance Ricardo attached to the factor of foreign trade. In his article to the Encyclopedia Britannica, Ricardo argued,

> 'Let these /food and raw products/ be supplied from abroad in exchange for manufactured goods, and it is difficult to say where the limit is at which you cease to accumulate wealth and to derive profit from its employment ...'[2]

He reiterated this even more forcefully in his letter to Trower in 1820. 'I contend for free trade in corn on the ground that while trade is free, and corn cheap, profits will not fall however great the accumulation of capital.'[3]

If these were Ricardo's policy and private views, they were equally a significant part of his Principles. In the chapter on profits he distinguished the future of an 'extensive country with land of poor quality and where the import of food is prohibited,' from that of 'small fertile countries' with free import of food. In the first, even a very small accumulation of capital would result in a fall in the rate of profit and a rise of rent. The latter, however, could pursue a high rate of accumulation without any decline in the rate of profit and any great rise in rent.[4]

Such an interpretation of the contextual framework of Ricardo's theory completely modifies the whole import of his models of distribution

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1. Mark Blaug, Ricardian Economics, A Historical Study, New Haven, 1958, pp. 31 - 32
2. Cited in M. Dobb, Theories of Value and Distribution, p. 90
3. Ibid., p. 90
4. Ricardo, Principles, p. 126

and accumulation. If foreign trade was a prominent feature in Ricardo's dynamic forecasts, technical change was equally so. Ricardo emphasized that the effect of machinery was analogous to that of foreign trade. The introduction of machinery or cheap foreign goods allowed commodities to fall in value. The extension of machinery or cheap foreign goods also allowed a low cost of labourers' subsistence, and thus brought about a rise in profits.[1] Ricardo's intervention in the debates on the corn laws has a very plausible influence on the interpretation one can give to his model of distribution. We cannot ignore the points he wished to make by using such a model. Dobb and Blaug have shown the intimate connection between theory and context with respect to foreign trade and the corn laws. Similarly, we can find an equally important connection with respect to technical change and the machinery debates. First, however, we will look at the explicit consideration Ricardo gave to the impact of technical change, both in agriculture and industry, on distributive shares.

Even in his very early work, Ricardo drew attention to improvement. 'If by foreign commerce, or the discovery of machinery, the commodities consumed by the labourer should become cheaper, wages would fall; and this, as we have before observed, would raise the profits of the farmer, and therefore, all other profits.'[2] Equally, such improvements would 'lower for a time rents'.[3] Any reduction in capital accumulation both reduced wage and rent shares and raised the profit share. But, as Ricardo repeated in the first edition of the Principles, such a retrogressive move was not necessary.

> 'The same effects may however be produced, when the wealth and population of a country are increased, if that increase is accompanied by such marked improvements in agriculture,

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1. Ricardo, Principles, pp.131 - 132
2. An Essay on the Influence of a Low Price of Corn, p.26
3. ibid., p.19

> as shall have the same effect of diminishing the necessity of cultivating the poorer lands, or of expending the same amount of capital on the cultivation of the more fertile portions.'[1]

Ricardo envisaged two types of capital accumulation. The first abstracted from technical change. In this situation, when, capital accumulated, the value of that capital also rose. Since such accumulation demanded a widening of margins of cultivation, it caused a rise in wage shares and a relative fall in profits. But Ricardo also considered capital embodied technical change. Thus the capital stock could rise, but its value fall. The addition to capital could be made by the aid of machinery, thus preventing any rise in the necessary proportions of labour. The wage share in this case, would stay the same or fall.[2]

As we have seen, the crucial variable in the whole process of accumulation was the wage share. This wage share was an aggregate of the natural wage as distinct from the market wage. The natural wage, as Ricardo carefully pointed out, was a social subsistence, dependent 'on the habits and customs of the people'.[3] The subsistence wage was, however, tied to some extent to diminishing returns in agriculture, so that in the process of pure capital accumulation, (that is, capital accumulation without technical change) the natural wage share rose. Foreign trade and technical change, however, prevented this eventuality, so that,

> 'the natural price of all commodities, excepting raw produce and labour, has a tendency to fall, in the progress of wealth and population; for though, on the one hand, they are enhanced in real value, from the rise in the natural price of the raw material of which they are made, this is more than counterbalanced by the improvements in machinery, by the better division and distribution of labour, and by the increasing skill, both in science and art, of the producers.'[4]

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1. Ricardo, Principles, (1st edition) p.79
2. Ricardo, Principles, p.95
3. ibid., p.97
4. ibid., p.94

The actual condition of the working classes, however, was dependent not on the natural wage, but on the differential between the market wage and the natural wage. The market wage rose with the process of capital accumulation and economic growth, but the permanence of this increase in market wages was dependent on changes in the natural wage.[1] In the process of pure capital accumulation, the natural wage share also rose with rising marginal production costs. Any rise in market wages also ultimately resulted in higher rates of population growth, and thus in a reduction in the differential between market and natural wages.

> 'The friends of humanity cannot but wish that in all countries the labouring classes should have a taste for comforts and enjoyments, and that they should be stimulated by all legal means in their exertions to procure them. There cannot be a better security against a superabundant population. In those countries, where the labouring classes have the fewest wants, and are contented with the cheapest food, the people are exposed to the greatest vicissitudes and miseries.'[2]

Again, however, Ricardo introduced factors preventing the tendency to convergence of market and natural wages. In 'an improving society' market wages could stay indefinitly above natural wages, 'for no sooner may the impulse, which an increased capital gives to a new demand for labour be obeyed, than another increase of capital may produce the same effect.'[3]

Technical change acted to reduce the real costs of providing the wage share. Thus technical progress, in the necessary consumer goods sector, at least, helped to reduce the value of the natural wage. Such a change in techniques could also allow the maintenance of a greater differential between market and natural wages. If this differential could be maintained for any length of time, then former luxuries became new needs. Subsistence wage levels thus rose, and with this, the rate of population growth fell.

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1. Ricardo, Principles, p.96
2. ibid., p.101
3. ibid., p.95

This type of increase in natural wages brought great gains to the condition of the working classes. It was, therefore, in sharp contrast to the increase in the natural wage share brought about by rising population and rising marginal costs.

Ricardo noticed, moreover, that technical change not only affected the level of social subsistence, but also affected the composition of that subsistence. The extent to which technical change brought about a substitution effect between agricultural and manufactured goods in the wage basket had very real significance for the impact of the law of diminishing returns. Ricardo explicitly dissociated himself from the view he attributed to both Smith and Malthus, that the wage basket consisted entirely of corn, so that population and profits could be tied entirely to the provision of food.[1] That the wage basket might tend increasingly to consist of more than food followed from the very logic of Ricardo's model of accumulation.

> 'From manufactured commodities always falling, and raw produce always rising, with the progress of society, such a disproportion in their relative value is at length created, that in rich countries a labourer, by the sacrifice of a very small quantity only of his food, is able to provide liberally for all his other wants.'[2]

That workers could and did buy manufactured goods limited the impact over the whole economy of diminishing returns in the agricultural sector. Ricardo, as Samuel Hollander, has shown, recognized this before even his Essay on Profits.[3] Ultimately, the wage was the crucial variable, not the price of corn. It is this attention which Ricardo gave to the composition of the

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1. D. Ricardo, Principles, pp.293 and 406 - 407; Notes on Malthus, p.115 Ricardo is perhaps commenting on this in his reaction to the possibility of a glut of necessaries. He replies, 'could such a state of things exist? Would only such a limited number of commodities be produced? Impossible, because the labourers would be glad to consume conveniences and luxuries if they could get them.' Notes on Malthus, p.312
2. D. Ricardo, Principles, p.97
3. Samuel Hollander, 'Ricardo's Analysis of the Profit Rate 1813 to 1815', Economica, 40, August, 1973, p.282

wage basket that led him to a very ambivalent position on the Malthusian population theory. Ricardo did find the Malthusian principle too crude theoretically,[1] but he endorsed the general dogma on the issue.[2] His ambivalence shows even more clearly in the Principles where he argued that high wages need not necessarily lead to population increase.

> 'the amended condition of the labourer, in consequence of the increased value which is paid him, does not necessarily oblige him to marry and take upon himself the charge of a family - he will, in all probability, employ a portion of his increased wages in furnishing himself abundantly with food and necessaries, - but with the remainder he may, if it please him, purchase any commodities that may contribute to his enjoyments - chairs, tables, and hardware; or better clothes, sugar, and tobacco.'[3]

Ricardo, however, stopped at this point and conceded the argument to Malthus. In the same paragraph he concluded,

> 'But although this might be the consequence of high wages, yet so great are the delights of domestic society, that in practice it is invariably found that an increase of population follows the amended condition of the labourer; and it is only because it does so, that, with the trifling exception already mentioned, a new and increased demand arises for food. This demand then is the effect of an increase of capital and population, but not the cause - it is only because the expenditure of the people takes this direction, that the market price of necessaries exceeds the natural price, and that the quantity of food required is produced.'[4]

What Ricardo had to say about the impact of technical change on wages was also crucial to his discussion of profits. Technical change did not have a direct impact on the rate of profit. Indeed, profits changed, in any circumstances, only in response to developments in the wage goods sector. Technical change could thus be said to raise the rate of profit only to

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1. D. Ricardo, Notes on Malthus, p. 115
2. ibid., p. 262
3. D. Ricardo, Principles, p. 407
4. ibid., p. 407. Ricardo's first edition did not refer to this as a 'trifling exception'.

the extent that it reduced the cost of wage goods. Any change in techniques which affected only luxury goods consumed by capitalists and landlords could induce no change at all in the rate of profit. In an extreme situation, where wage earners consumed only corn, technical change in the industrial sector could affect prices, but not the rate of profit.

> 'The rate of profit is never increased by a better distribution of labour, by the invention of machinery, by the establishment of roads and canals, or by any means of abridging labour either in the manufacture or in the conveyance of goods. These are causes which operate on price and never fail to be beneficial to the consumers, ... but they have no effect whatever on profit. On the other hand, every diminution in the wages of labour raises profits, but produces no effect on the prices of commodities'.[1]

Perhaps one of the most longstanding and polemical concerns of the issues arising from Ricardo's work on technology and distribution was that of the impact of improvement on rents. From his early corn model through to the propositions of his Principles, Ricardo argued that the necessary effect of both improvements and free trade in corn was the reduction of rents. The proof took on the political form that the interest of the landlord was opposed to that of every other class of the community.[2] The level of rent was based on the differential products of a series of capital inputs. Thus whatever reduced the inequality in the product obtained from each successive capital input on the same or new land reduced rent.[3] The polemical implications Ricardo drew from this finding were, however, not at all acceptable to many of his contemporaries. Malthus, in particular, continually disputed Ricardo's enmity to landlords. In fact, however, Ricardo never looked on the inverse relation between rents and agricultural improvements as anything but a short term interim effect. Sraffa has

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1. D. Ricardo, Principles, p.33
2. Ricardo, 'An Essay on ... the Profits of Stock', p.21
3. D. Ricardo, Principles, p.83

argued that Ricardo merely added a footnote in the third edition conceding some ultimate benefit to the landlord.[1] But even in his polemical chapters against Malthus and the corn laws Ricardo had conceded that the landlord did have a long term interest in agricultural improvement.

> 'The machine which produced the most important article of consumption would be improved, and would be well paid for according as its services were demanded. All the advantages would, in the first instance, be enjoyed by labourers, capitalists, and consumers; but with the progress of population, they would be gradually transferred to the proprietors of the soil'.[2]

The place where Ricardo most emphatically denied the charge of disassociating landlords from the gains of economic growth was in his Notes on Malthus,

> 'Perhaps in no part of his book has Mr. Malthus so much mistaken me as on this subject - he represents me as supporting the doctrine that the interests of landlords are constantly opposed to those of every other class of the community, and one would suppose from his language that I considered them as enemies to the State. ... All I meant to say of the landlords interest, was, that it would be for his advantage that the machine which he had for producing corn should be in demand - that in fact his rent depended on it; - that on the contrary it was the interest of the consumer to use the foreign machine, if that would do the work cheaper. It is only in this case, that the interests of the landlord and consumer really, if well understood, come in contact. ... I have indeed observed that improvements in agriculture were in their immediate effects injurious to the landlord, ... Great improvements in any branch of production are in their first effects injurious to the class who are engaged in that branch, but this is the statement of a fact or an opinion, and cannot be supposed to cast any injurious reflections'.[3]

Ricardo, therefore, associated rising rents with the general tendency of capital accumulation, with the proviso that this abstracted from technical change. The initial impact of technical change in agriculture, ceteris paribus was to reduce rents. However, Ricardo observed that in

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1. Sraffa, 'Introduction', p.lv
2. D. Ricardo, Principles, p.335, also see p.412
3. Ricardo, Notes on Malthus, pp.117 - 118

the general process of growth rents rose, though perhaps at a more tempered rate than in the non-improving economy. Rents rose in the real world along with prosperity. This rise in rents was the dominant tendency of a combination of rent raising and rent reducing factors: the accumulation of capital, population increase, improvements in agriculture, and a high market price for agricultural products caused either by foreign demand or the expansion of commerce and industry.[1] Ricardo drew a distinction in this as in other cases between the results of his restrictive model, and his conception of the overall growth process.

Technical Change: Mechanisms and Processes

I have shown that Ricardo gave much more than notional consideration to the impact of technical change. Sceptics, however, may still believe that he had no perception of the processes of technical change. The sceptics have generally recognized several gaps in Ricardo's perceptions of technical change: they claim that Ricardo did not take up Smith's discussion of the division of labour. He did not make clear the distinction between capital saving and labour saving techniques. His model did not have built into it a self generating technical change as did Smith's, where the division of labour was embodied in new techniques, and Marx's, where the drive to technical change was encompassed in the tendency to the rising organic composition of capital.

However, several of these factors are discussed by Ricardo. What he failed to do was to draw out their full implications. Thus it seems evident that, although Ricardo did not go into further discussion of the detail division of labour, which incidentally he probably took for granted, he did develop the concept to explain the gains from international specialization in production.

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1. Ricardo, Notes on Malthus, p.159

Ricardo also clearly applied himself to the problem of technical change and the structure of fixed capital. He constantly spoke of the land in the image of machinery. The first result of foreign trade or agricultural improvement was described as a loss on obsolete capital'. Ricardo was unimpressed with this objection to change,

> 'We might just as fairly have been told, when the steam engine, or Mr. Arkwright's cotton-machine, was brought to perfection, that it would be wrong to adopt the use of them, because the value of the old clumsy machinery would be lost to us. That the farmers of the poorer lands would be losers, there can be no doubt, but the public would gain many times the amount of their losses.'[1]

This analysis of the impact of technical change on the capital invested in inferior land was part of his more general perception of the comparative importance of different capital structures. Ricardo argued that in rich countries where industry was more capital intensive there would be greater distress from any recession than in a poor relatively labour intensive country. Labour or its circulating capital was more mobile than fixed capital, thus the greater the capital intensity of the industry the greater the possible interim loss from the introduction of new techniques.[2]

Ricardo defined quite early on in his work his notion of capital, and the criteria for its separation into its fixed and circulating elements. Capital was generally defined as time. Capital was fixed or circulating according to its durability or the time it took to consume. But as Ricardo noted, the division was one 'not essential, and in which the line of demarcation cannot be accurately drawn'.[3] As Ricardo was to point out later, however, the division was actually very important. The employment impact of capital accumulation was a function of the proportions embodied in fixed and circulating elements. I will discuss this in greater detail in the final

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1. Ricardo, 'An Essay on ... the Profits of Stock', p.33
2. D. Ricardo, Principles, pp.266 and 271
3. ibid., p.52

section on machinery and labour.

The introduction of machinery was specifically not exogenous to Ricardo's theory. The tendency to rising proportions of machinery to labour over time was explained by the movements of the key variables of Ricardo's model. First, Ricardo had some idea of capital saving techniques. It was in this sense that he regarded machinery as the product of less labour than that which it displaced. A rise in wages had a greater impact on the value of commodities produced by circulating capital than those commodities produced by fixed capital.

> 'Through their [i.e. machines] influence an increase in the price of provisions which raises wages, will affect fewer persons ... and the saving which is the consequence shows itself in the reduced price of the commodities manufactured.'

The introduction of this fixed capital saved on total capital. Thus 'neither machines, nor the commodities made by them rise in real value, but all commodities made by machines fall, and fall in proportion to their durability'.[1]

Second, this peculiar effect of the introduction of machinery as well as the influence of differing comparative capital structures were factors which led Ricardo to take up discussion of the choice of techniques, or the impact of factor prices on technologies.[2] Ricardo connected the tendencies in factor prices to a tendency to rising capital intensity in industry. Thus he argued,

> 'In the distribution of employments amongst all countries, the capital of poorer nations will be naturally employed in those pursuits, wherein a great quantity of labour is supported at home, because in such countries the food and

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1. D. Ricardo, Principles, p.42
2. This has been previously referred to as the Ricardo effect. I prefer to separate this term, which was Hayek's conception from Ricardo's view of the problem. The two have been distinguished by C. E. Ferguson, 'The Specialization Gap: Barton, Ricardo and Hollander', History of Political Economy, v, Spring, 1973, pp.6 - 11

> necessaries for an increasing population can be most easily procured. In rich countries, on the contrary, where food is dear, capital will naturally flow, when trade is free, into those occupations wherein the least quantity of labour is required to be maintained at home.'[1]

Moreover, in the process of economic growth without substantial innovation there was an increasing tendency for wage shares to rise and 'with every rise in the price of labour, new temptations are offered to the use of machinery'.[2] It was with this in mind that Ricardo came to find acceptable John Barton's argument that 'as arts are cultivated, and civilization is extended, fixed capital bears a larger and larger proportion to circulating capital.'[3] Ricardian theory contained the embryonic prediction of the fully mechanized economy.

Yet, factor prices were also the major determinants of the <u>slow</u> diffusion of technical innovation. Ricardo explained the slow diffusion of new techniques by low relative wages. It is thus that we understand his image of the American economy, as a relatively labour intensive economy. The choice of techniques was, in Ricardo's words, 'the constant competition' of 'machinery and labour'.[4]

> 'We here see why it is that old countries are constantly impelled to employ machinery, and new countries to employ labour. With every difficulty of providing for the maintenance of men, labour necessarily rises, and with every rise in the price of labour, new temptations are offered to the use of machinery.'[5]

Ricardo not only recognized that technical change rather than simple capital accumulation was the faster and more painless road to economic growth,[6] but he was sensitive to the fine divisions and types of change in technique. This was particularly apparent in his view of agricultural

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1. D. Ricardo, <u>Principles</u>, p.349
2. ibid., p.41
3. ibid., p.396
4. ibid., p.395
5. ibid., p.41
6. ibid., p.279

improvement. One type of improvement added to soil fertility by better crop rotation or the use of fertilizers. This land saving innovation reduced real rents. The second type of improvement was that which raised capital and labour productivity. The effectiveness of this capital saving improvement was limited by physical diminishing returns.

The analysis of improvement in the agricultural sector clarified Ricardo's choice of the key dynamic factors in growth. It was, furthermore, the style of improvement in this key sector which was fundamental to the rate of capital accumulation. The rate of capital accumulation depended in the first instance on labour productivity and the fertility of the soil. Ricardo agreed with Smith that in new settlements 'where the arts and knowledge of countries far advanced in refinement are introduced', the rate of capital accumulation exceeded the rate of population growth.[1] Labour productivity, however, was equally dependent on capital formation. Ricardo, therefore, reproved Malthus for comparing the labour productivity of various nations on the basis of the inclination to work. Such criteria completely neglected relative levels of capital formation.[2]

Labour productivity, as I noted earlier, was central to Smith's conception of the growth process. It is popularly believed that, in contrast to Smith, Ricardo was so entrenched in a model based on the accumulation of capital that he ignored the significance of labour productivity. Here one can see, however, that Ricardo carried over the spirit of Smith's ideas by seeing labour productivity along with the fertility of the soil as the source of capital accumulation. Ricardo not only sought to explain national differences in labour productivity, but

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1. D. Ricardo, Principles, p.98
2. Ricardo, Notes on Malthus, p.87

he sought to dissect this productivity by enquiring into skill. Labour productivity depended on comparative levels of skill, in turn related to comparative levels of capital formation. Ricardo, unlike Smith, did not regard skill as an attribute given by the division of labour. Skill was, instead, a capital good, a factor of production provided by the labourer. Skill was 'dependent on the interests fathers may feel to give their children this dexterity and ingenuity', and the supply of such labour depended on the costs of conferring this dexterity.[1]

The subsistence of labour now was regarded as providing not only for the continuity of the day to day labour of a worker and his descendants, but for the production of more and more complex and skilled labour.

Finally, Ricardo also conceived of a definite role for good government in the direction of capital accumulation and growth. Again like Smith, he distinguished badly governed from well governed nations.

> 'In those countries where there is abundance of fertile land, but where, from the ignorance, indolence, and barbarism of the inhabitants, they are exposed to all the evils of want and famine, and where it has been said that population presses against the means of subsistence, a very different remedy should be applied from that which is necessary in long settled countries, where from the diminishing rate of the supply of raw produce, all the evils of a crowded population are experienced. In the one case, the evil proceeds from bad government, from the insecurity of property, and from a want of education in all ranks of the people. To be made happier they require only to be better governed and instructed, as the augmentation of capital, beyond the augmentation of people, would be the inevitable result. No increase in the population can be too great, as the powers of production are still greater.'[2]

The transfer to good government in such a country would involve higher rates of capital accumulation benefiting all.[3]

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1. Ricardo, Notes on Malthus, p.226
2. D. Ricardo, Principles, p.93
3. ibid., p.98

Machinery and Labour

As I have shown, Ricardo was sensitive to the implications of a country's comparative capital structure. Techniques reflected relative factor costs, and the impact of any change in trade patterns or factor costs was dependent on the particular composition of capital. Ricardo did not at first, however, recognize the employment implications of the composition of capital. His chapter on machinery, the only significant change in the third edition, detailed his recognition of the employment impact of a change in techniques. Ricardo's change of view did not have purely theoretical implications. The problem could not be separated from the current debate on machinery and labour.

When Ricardo publicly announced his change in opinion he said that though he had not published anything on the subject, 'yet I have in other ways given my support to doctrines which I now think erroneous'.[1] This probably referred to the part he took in the anti-Owenite campaign which I will say more about below. In fact, however, Ricardo had also referred to labour saving machinery explicitly in his Essay on Profits where he argued,

> 'The effects on the interests of this class, [the impact of a low price of corn on the working classes] would be nearly the same as the effects of improved machinery, which it is now no longer questioned, has a decided tendency to raise the real wages of labour.'[2]

In his first edition Ricardo had taken this for granted, and only recognized capital transfer costs. It is also true that even when something other than an Owenite argument for technological unemployment was put to him, Ricardo was similarly unimpressed. Ricardo's early reaction to John Barton, whose work he came later to endorse bears this out. In answer to Barton, Ricardo simply asserted that the accumulation of fixed capital would not

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1. D. Ricardo, Principles, p.386
2. Ricardo, 'An Essay on the Profits of Stock', p.35

have any adverse impact on employment. The quantity produced over and above necessary consumption would be the same in both cases. Moreover, he regarded the possibility of technological unemployment as highly unlikely.

> 'The case is evidently put for the sake of argument, and could not really take place, for there is no new creation of machinery which entirely supersedes the use of the labour of man - he must regulate its motion and velocity - he must procure coals for the fire necessary to work it - he must attend to its annual repairs.'[1]

Ricardo repeated his general reaction when he commented on McCulloch's partial endorsement of Barton's theory of technical change.

> 'The employment of machinery I think never diminishes the demand for labour - it is never the cause of a fall in the price of labour, but the effect of its rise.'[2]

Ricardo's change of mind, as embodied in the third edition, took place when he came to consider not simply technical change in a general growth context, but when he analyzed the case of a strong switch to fixed capital in conditions of capital scarcity. The initial accumulation of a stock of fixed capital could lead to a rise in the growth rate of the whole capital stock, but reduce circulating capital. Inventions could be labour saving over the economy as a whole since a certain amount of capital had to be withdrawn from the production of final output (on which depended circulating capital and the demand for labour) to aid in the construction of machinery. The high costs of the accumulation of this fixed capital would be later compensated by lower labour or 'circulating capital' input requirements in the operation of the new machines. This labour displacement in one sector would generate a surplus to re-employ labour in other sectors. The time of difficulty would be the period of accumulation prior to the

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1. Letters 1816 - 1818, Works, vii, D. Ricardo to John Barton, 20 May, 1817, 159
2. Letters 1819 - 1821, Works, viii, Ricardo to McCulloch, 29 March, 1820, 171

full operation of the new machines. The crucial problem was an economy wide labour saving effect - that is, the interim period when capitalists expected to invest in machinery to gain the same income, yet to produce a smaller output. Once accumulated, however, the fixed capital stock would generate gains in productivity and in the surplus. Rising rates of growth would lead to no strain on savings and would thus ultimately result in a higher demand for labour.[1]

Ricardo himself emphasized that he was analyzing a relatively restricted case, and warned his readers from making the inference that machinery should be discouraged. These results applied only to the situation where machinery was suddenly discovered and extensively introduced. Generally, discoveries were more gradual, and rather than diverting capital from another sector, they encouraged a higher rate of saving.[2]

Ricardo's discovery that technical change could result simultaneously in a rise in net income or total surplus, and in a decline in gross income, or total output did not, however, disturb his general theory of capital accumulation. Prior to the discovery, he had analyzed the sources of capital accumulation in terms of the distinction between gross and net revenue. He had disputed Smith's view that the power of any country was to be assessed in proportion to the value of its annual product, because this was the fund from which taxes were ultimately paid. Ricardo separated himself from this view and argued that taxes and savings could only be

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1. D. Ricardo, Principles, pp.389 - 391
   See also John Hicks, A Theory of Economic History, Oxford, 1969, p.153; and J. Hicks, Capital and Time, Oxford, 1973; also J. Hicks, 'A Reply to Professor Beach', Econ.Jrl., 81, Dec.,1971, 925
   Ricardo, himself clearly explained the dynamic process.
   > 'I have before observed, too, that the increase of net incomes, estimated in commodities, which is always the consequence of improved machinery, will lead to new savings and accumulations. These savings it must be remembered are annual, and must soon create a fund, much greater than the gross revenue, originally lost by the discovery of the machine'. Principles, p.396
2. D. Ricardo, Principles, p.395

derived from rent and profits, that is, from net revenue and not from gross revenue. He saw no reason for supporting Smith's preference for agricultural investment. This preference was based on what Ricardo regarded as the misguided view that agricultural investment created the greatest annual product because it gave motion to the greatest amount of 'industry', that is, productive labour. Ricardo added a footnote in the third edition denying Say's charge that he 'considered as nothing, the happiness of so many human beings',[1] that is, ignoring the employment generating characteristics of particular industries.

Ricardo's discovery was completely compatible with his previous analysis of the mechanisms of accumulation. The rate of accumulation was dependent on net revenue. The capitalist only had an interest in maintaining his rate of profit and, therefore, this net revenue. His total product had no bearing on this. However, as Ricardo pointed out, the 'power of supporting a population' and the 'situation of the labouring classes' depended on total product and not on the surplus.[2] Ricardo pointed out that the condition of the working classes was also dependent on unproductive employment.

> 'Independently of the consideration of the discovery and use of machinery, to which our attention has been just directed, the labouring classes have no small interest in the manner in which the net income of the country is expended ... As the labourers, then, are interested in the demand for labour, they must naturally desire that as much of the revenue as possible should be diverted from expenditure on luxuries, to be expended in the support of menial servants.'[3]

The chapter on machinery has created major difficulties for historians of economic thought. They have wondered about Ricardo's own assessment of the significance of the chapter. They have been even more puzzled by the

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1. D. Ricardo, Principles, p.349
2. ibid., p.390
3. ibid., pp.392 - 393

apparent contradiction between the chapter and the rest of Ricardo's model. Most historians of thought have seen the chapter as something of a quirk. Pasinetti has argued that the introduction of machinery violated the assumptions of Ricardo's model. The chapter may perhaps not have been a contradiction but was 'an honest acknowledgement' by Ricardo 'of the limits of his own theory.'[1] Blaug argues that Ricardo had hidden motives for not carrying through with the analysis of labour saving technical change, 'to have done so would have vitiated the simple model which he had constructed to convey the undesirable consequences of the corn laws.'[2] Finally, Hollander argues that Ricardo's failure to re-examine his model in the light of his new chapter simply reflected his adherence to the methodological position that the realism of the assumptions was of less significance than the predictions derived from them.[3] Hollander, more recently, has argued that Ricardo's change of position was not really as significant as he had imagined - that the raw materials for the new theory were implicit in the first edition of his work.[4]

All of these views of Ricardo simply deny his own perception of the chapter. An analysis of ideas which dismisses the very point a thinker insists he is making is very unsatisfactory history. We can learn more about the significance and implications which Ricardo attached to this chapter if we look at contemporary reactions and his own defences.

The chapter was of obvious importance to the current machinery debates, the debates on technical change and unemployment which pervaded most of this

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1. L. Pasinetti, 'A Mathematical Formulation of the Ricardian System', Review of Economic Studies, 1959 - 60, 92
2. Mark Blaug, Ricardian Economics, p.71
3. Samuel Hollander, 'Some Technological Relationships in the Wealth of Nations and Ricardo's Principles', Can. Jrl. Pol. Science, xxxii, May, 1966, 187
4. Samuel Hollander, 'The Development of Ricardo's Position on Machinery', Hist. Pol. Econ., 3, Spring 1971, pp.116 and 118

period of the industrial revolution. Ricardo himself participated in discussions of Owenism, spade husbandry and the plight of the handloom weavers. I will say more about this below, as the whole issue became very important to subsequent debate. Ricardo's early attitude both to Owen and schemes for the re-employment of the weavers was quite disparaging. He regarded Owen as a visionary as little deserving of attention as tory fanatics such as Southey.[1] He was scornful of Owen's hopes that community feeling would overcome self interest.

Ricardo's mind on this issue, however, was not closed. He did become involved in a committee of Owenite sympathizers, to examine Owen's plans. But Ricardo explicitly separated himself from any commitment to the cause.[2] The most he would concede was what he stated in the House of Commons,

> 'In a limited degree he thought the scheme likely to succeed, and to produce, where it did succeed, considerable happiness, comfort, and morality, by giving employment and instruction to the lower classes ... He could not, however, go along with him [Owen] in the hope of ameliorating the condition of the lower classes to such a degree as he seemed to expect.'[3]

He saw himself purely as an economic consultant on the Committee. The Committee, however, concluded in generally favourable terms to Owen's views, and several accused Ricardo of complicity in the heresy of Owenism. Trower reported his own amazement at Ricardo's action.[4] Ricardo attempted to exonerate himself by claiming he was not bound to approve the plans, only to question them.

> 'Can any reasonable person believe, with Owen, that a society, such as he projects, will flourish and produce more than has ever yet been produced by an equal number

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1. Ricardo to Trower, 26 January, 1818, vii, p.247
2. See the correspondence between Trower and Ricardo; Letters 1819 - 1821, Works, viii, Trower to Ricardo, 4 July, 1819, 42
   ibid., Ricardo to Trower, 8 July, 1819, 46
3. 'Meeting on Mr. Owen's Plan', 26 June, 1819, Speeches and Evidence, Works, v, pp. 467 - 468
4. Letters 1819 - 1821, Works, viii, Trower to Ricardo, 8 July, 1819, 42

> of men, if they are to be stimulated to exertion by a regard to the community, instead of by a regard to their private interests? Is not the experience of ages against him?'[1]

Similarly, Ricardo was not at all convinced by the early strategy of the handloom weavers' lobby. John Maxwell presented the motion, which was to recur throughout the 1820's and 1830's that there be a tax on the power loom to compensate for the tax on workers' consumption goods. Ricardo regarded this as yet another restriction on trade, and argued that it was, rather, the duty of government to provide incentives for the development, and not the restriction, of industry.[2]

Ricardo, however, seems to have expressed less opposition to the Owenite schemes for spade husbandry. He consistently disclaimed any knowledge of agricultural techniques, but saw no reason why the scheme would not work. As he stated in the House of Commons,

> 'For what did the country want at the present moment? A demand for labour. If the facts stated of spade husbandry were true, it was a beneficial course, as affording that demand'.

He separated this scheme from other aspects of Owenism: 'a division of the country into paralellograms, or an establishment of a community of goods, and similar visionary schemes'. Ricardo went so far as to urge that the government circulate 'useful information', and supported the appointment of a committee to look into the matter.[3]

Just as Ricardo, prior to his rethinking of the machinery and labour question, played an active part in contemporary discussions, so he continued to do so after publication of his chapter. Even in his chapter

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1. Letters 1819 - 1821, Works, viii, Ricardo to Trower, 8 July, 1819, 46
2. Ricardo, 'Cotton Weavers', Speeches and Evidence, Works, v, 29 June, 1820, pp.68 - 69
3. 'Sir W. de Crespigny's Motion Respecting Mr. Owen's Plan', 16 Dec., 1819, Speeches and Evidence, pp.31 and 35. Also Ricardo's reaction to Malthus sarcasm towards spade husbandry, Notes on Malthus, p.239

he recognized the political implications of his logic and wrote,

> 'That the opinion entertained by the labouring class, that the employment of machinery is frequently detrimental to their interests, is not founded on prejudice and error, but is conformable to the correct principles of political economy'.[1]

Ricardo, moreover, reaffirmed these views in a speech in the House of Commons in criticizing a potentially 'useful' popular pamphlet against machine breaking by Cobbett. Here and in his correspondence, Ricardo now dissociated himself from the popular middle class dogma on machinery. He stood up to McCulloch's wrath that he had given authority to 'all those who raise a yell against the extension of machinery', and that by his word, 'the laws against the Luddites are a disgrace to the Statute Book'.[2] Malthus too, objected to the implications of what Ricardo had to say - that his views were 'Liable to be taken fast hold of by the labouring classes'.[3] Ricardo, undaunted, pressed consideration of the question through the Political Economy Club. After two delays it was finally discussed in February, 1822. But Ricardo was left disappointed in the reception of his views, 'I could hardly satisfy myself of the general

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1. D. Ricardo, Principles, p.392
2. Letters 1819 - 1821, Works, viii, McCulloch to Ricardo, 5 June, 1821, 385
   McCulloch's anger was justified since Ricardo had only recently criticized him for his view that an increase in the proportion of fixed capital reduced the demand for labour. See ibid., McCulloch to Ricardo, 21 June, 1821, p.393; and Ricardo to McCulloch, 30 June, 1821, 400
   This reason for McCulloch's anger was also mentioned by Malthus in his letter to Ricardo, Letters 1821 - 1823, Works, ix, 7 July, 1821, 9
3. ibid., Malthus to Ricardo, 16 July, 1821, 18. Malthus was the first to find out about Ricardo's new views. He at first saw them as supporting his own views on machinery and over-production. See Malthus to Sismondi, Letters 1819 - 1821, 377. Ricardo, however, quickly dissociated himself from Malthus' views, see ibid., Ricardo to Malthus, 18 June, 1821, 387

opinion on that disputed point'.[1] Ricardo also continued to stress the importance of his new position, particularly in criticizing the popular political economy of his supporters. He drew repeated attention to this in his notes on McCulloch's lecture. At three different points in his criticisms he objected to McCulloch's persistently stated views that the demand for labour was a function of the accumulation of capital and that the interests of masters and workmen were always harmonious.[2] Ricardo placed similar weight on the point in his criticism of James Mill's popular work, Elements of Political Economy.

Ricardo's unequivocal faith in his stand did not, however, encourage him to change his practice and to recommend any change in policy towards machinery. He concluded his chapter by arguing that nothing should be done to discourage technical innovation for fear of capital export. If the use of machinery led to higher returns, capital would flow to the country which encouraged technical change.

> 'By investing part of a capital in improved machinery, there will be a diminution in the progressive demand for labour; by exporting it to another country, the demand will be wholly annihilated'.[3]

The critical reaction to Ricardo's chapter was primarily a doctrinal and empirical one. Most complained that the case he had set up was a very peculiar one. Few inquired into the analytical implications of the chapter. Malthus was one of these few who complained that he had not 'considered all the bearings of your concession on the other parts of your work'.[4] Ricardo

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1. The question 'Whether machinery has a tendency to diminish the demand for labour' was proposed by Ricardo for discussion on June 25, 1821. This was deferred until the next meeting, then deferred again at this meeting on December 3, 1821. It was finally discussed February 4, 1822.
   See Minutes of the Political Economy Club, iv, pp.43 - 46
   See Ricardo's report on the discussion in his letter to McCulloch, Letters 1821 - 1823, 18 Feb., 1822, p.159
2. Letters 1821 - 1823, Ricardo to McCulloch, 7 May, 1822, 194
3. D. Ricardo, Principles, p.397
4. Letters 1821 - 1823, Malthus to Ricardo, 16 July, 1821, 19

did not take up this challenge. The reasons for this were most likely not those given by Hollander, Blaug, and Pasinetti. Rather, it would simply not have worried Ricardo that the assumptions of the new chapter did not fit his model. His model was a highly specific one set up to show the consequences of hindrances to technical change and foreign trade. The difficulty posed by his new discovery was that it tempered only the positive force of his policy proposals on technical change.

Ricardo, unlike many of his middle class contemporaries, was left not completely complacent in his faith in the gains from trade, science, and technology. Few, however, have drawn attention to this general optimism. Donald Winch, at least, has placed the time scale of the predictions of Ricardo's model in perspective. The stationary state had no bearing on the immediate future. The tendency of profits to fall was checked by improvements in science and technology,[1] and recessions would soon correct themselves.

> 'It must be remembered too that the retrograde condition is always an unnatural state of society. Man from youth grows to manhood, then decays and dies; but this is not the progress of nations. When arrived to a state of the greatest vigour, their further advance may indeed be arrested, but their natural tendency is to continue for ages, to sustain undiminished their wealth, and their population'.[2]

The historian need no longer contrast the rapid technical change of the Industrial Revolution with the pessimism and gloom of classical economics. Ricardo's model of distribution and accumulation was an analytical tool moulded to clarify the primary importance of foreign trade and technical change. This purpose becomes obvious once we go beyond the confines of Ricardo's analytical model to what he actually said about the processes and impact of technical change. His purpose in his own time was

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1. D. Ricardo, Principles, p.120
2. ibid., p.265

misunderstood by most of his critics and supporters. But Ricardo nonetheless dominated the early Nineteenth Century discussion of the machinery question. His critics based their own contributions on an analysis of technology. They began from a criticism of Ricardo's strict model, yet because they had neglected his wider discussion, they often returned, in the end, to Ricardo.

CHAPTER THREE

The 1820's: The Political Economy of Manufactures

Ricardo's provocation not only of his critics, but of his closest followers, by his novel analysis of the machinery issue is indirect evidence of deeper concerns of his contemporaries. Ricardo's new ideas rankled, and sharpened an old source of contention with working class dissent from industrialization. Owenism and the machinery riots were very real bogies for the optimists of early Nineteenth Century industrial capitalism. In the years just after Ricardo's death much of the work in political economy which addressed itself to the prospects of the British economy did project a certain polemical tone. This political economy can be characterized as purposive inquiry into the universal benefits of industrialization. The contrary ideology of an increasingly popular Owenite utopianism was the real back drop to the tone of this new programme of inquiry by political economists.

Owenism and Political Economy

Owenite utopianism had a definite legacy in schemes for the employment of the poor, and public works projects which had been in great vogue in the period just prior to the 1820's.[1] The government, in 1817, had granted funds for public works schemes, and Owen had, in fact, been put on the Committee of the Association for the Relief of the Manufacturing Poor in the same year. Owen's plans were very much in the tradition of comprehensive blueprints drawn up to solve a whole range of social evils. These usually involved varying themes on resettlement and cottage industry for the poor.[2] However, by the time of Liverpool's ministry the government looked on such

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1. See J. R. Poynter, Society and Pauperism 1795 - 1834, London, 1969.
2. R. G. Garnett, Co-operation and the Owenite Socialist Communities in Britain, 1825 to 1845, Manchester University Press, 1972, p.4

assistance as of little permanent value. Liverpool claimed that short term aid to workers in redundant occupations would only impede beneficial redeployment. In many ways the debate on public works and other social schemes was part of the wider debate on the crisis. Liverpool received an indicative letter from Kenyon in December, 1819 arguing that there should be no government interference even though he did not anticipate any return to affluence because of rising rates of mechanization.[1]

The promotion of employment schemes did, however, continue throughout this period. Now, however, it was increasingly identified with underconsumptionist economics. Malthus' interest in public works derived from his underconsumptionist ideas. His interest was based on the position that any transfer of funds from productive to unproductive expenditure increased the level of effective demand and the profit rate.[2]

The underconsumptionist idea also informed much of the basis of Owen's schemes. Owen argued that it was the lack of a profitable market that alone checked the beneficial industry of the working classes.[3] Owen, however, had more positive horizons particularly with respect to education and social organization. Owen relates carrying on extensive discussions with political economists. He was

> 'desirous to convince them that national education and employment could alone create a permanent national, intelligent, wealthy and superior population, and that these results could be attained only by a scientific arrangement of the people, united in properly constructed villages of unity and co-operation'.[4]

Certainly Owenism was what caught the imagination of those who conceived of either some direction or benefits from the industrial transformation of

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1. A. J. B. Hilton, 'The Economic Policies of the Tory Governments, 1815 - 1830', 1973, p.80
2. S. Hollander, 'Malthus and the Post-Napoleonic Depression', Hist. Pol. Econ., i, Fall, 1969, p.332
3. V. A. C. Gattrell, ed., Robert Owen, Report to the County of Lanark, London, 1969, p.210
4. The Life of Robert Owen written by himself, ed. John Butt, London, 1971.

Britain. The movement was eclectic enough to gather

> 'artisans with their dreams of short circuiting the market economy; the skilled workers with their thrust towards general unionism; the philanthropic gentry, with their desire for a rational planned society; the poor with their dream of land or Zion: the weavers with their hopes of self employment; and all of these with their image of an equitable brotherly community, in which mutual aid would replace aggression and competition'.[1]

The impact of machinery was the key element of Owenite economics. Owen argued that the huge productivity increase consequent on technical change entailed the exploitation, misery, and moral degradation of labour. He argued in his Report to the County of Lanark for an intensive agriculture based on spade husbandry which would both enable food supply to keep pace with population growth and provide for greater employment.[2] He maintained, in addition, that commercial competition had stimulated invention, but had made men selfish.

Machinery used in the context of the wage bond had degraded labour into a dispensable commodity. It had encouraged competition for wealth and divided men when they should have been united.[3] Owen wished to extract technical progress from the social arrangements in which it had been developed, and direct it in an attempt to avoid the minute division of labour.[4] In his community he envisaged all taking part in some one or more of the occupations in a department, 'ordered by every improvement that science can afford', and would alternate this employment with work in agriculture and gardening.

Needless to say, there was almost an over-reaction to Owen in middle

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1. E. P. Thompson, cited in R. C. Garnett, Co-operation and the Owenite Socialist Communities in Britain 1825 - 1845, Manchester University Press, 1972, p.11
2. Robert Owen A New View of Society and Report to the County of Lanark, ed. V. A. C. Gattrell, Harmondsworth, 1969, pp.211 - 215
3. V. A. C. Gattrell, 'Introduction', Robert Owen, pp. 12 - 13
4. Robert Owen A New View of Society and Report to the County of Lanark, p.251

class circles. Torrens referred to him as belonging 'to the order of political alchymists'.[1]

> 'Mr. Owen shows himself profoundly ignorant of all the laws which regulate the production and distribution of wealth. He tells us, that the distress to which the people of this country are exposed arises from scientific and mechanical power producing more than the existing regulations of society permit to be consumed.'[2]

McCulloch was no less scathing of the political economy of Owenism. He reported Owen's speech on the crisis in the Scotsman in 1819, but it was not until 1821 that he came to vent his full wrath on Mr. Owen. He pointed out that Owen's theories on spade husbandry, the division of the population into parallelograms, and the discarding of the minute division of labour were all wrong. The greatest drawback of such ideas was that they led to indolence. No individual could 'raise himself above the common herd'. The commercial arrangements of his textile communities were defective. They had no mechanism for adjusting the quantity of yarn produced to effective demand.

However, incredulity on the part of most political economists was not enough to perturb Owen from seeking the ear of the Political Economy Club. He attended as a guest of Grote in 1822 and presented the particulars of his plan for 'ameliorating the condition of mankind', and some of the principles of his system.[3]

The conflict between the political economists and the Owenite 'visionaries' did not solidify until the public debating sessions of the

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1. Robert Torrens, A Paper on the Means of Reducing the Poor Rates and of Affording Effectual and Permanent Relief to the Labouring Classes, London, 1817, p.514
2. Robert Torrens, 'Mr. Owen's Plans for Relieving the National Distress', Edinburgh Review, xxxii, October, 1819, p.468
3. Minutes, 6 May, 1822, Political Economy Club, Minutes, Centenary Volume, vi, London, 1921, 14

philosophic radicals and of an Owenite co-operative society.[1] The sectarian spirit of the philosophic radicals found a platform, though not a particularly acrimonious one. J. S. Mill reports one such debate on population which went on through five or six meetings. Another on the general merits of Owen's system lasted for three months.

> 'It was a little corp à corps between Owenites and political economists, whom the Owenites regarded as their most inveterate opponents; but it was a perfectly friendly dispute. We who represented political economy had the same objects in view as they had and took pains to show it; and the principal champion on their side was a very estimable man, with whom I was well acquainted, Mr. William Thompson of Cork, author of a book on the Distribution of Wealth and of an "Appeal" on behalf of Women against the passage in my father's Essay on Government.'[2]

This is not to say, however, that Mill took a particularly favourable stand on Owenism. Rather, he hoped that middle class fears of the extremes of Owenism would encourage reform, working class education, and more democratic institutions.[3]

Certainly it was not only the entrenched members of the Political Economy Club who took exception to Owen's schemes. Several dissidents too were not very convinced. John Barton, though he had taken great pains to stress the many limitations on the demand for labour in an industrializing society, did not promote projects for employing the poor. He argued that these ranged from the manufacturing corporations of Josiah Child to the village co-operatives of Owen. These did not increase the demand for labour.

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1. Joseph Hamburger, Intellectuals in Politics. John Stuart Mill and The Philosophic Radicals, Yale, 1965, p.26. The latter was probably the London Co-operative and Economical Society. It was a working class organization set up in 1821 by a group of printers. They also set up a co-operative housing experiment at Spa Fields and a co-operative store. See J. F. C. Harrison, 'The Steam Engine of the New Moral World; Owenism and Education 1817 to 1829', Journal of British Studies, 1967.
2. J. S. Mill, Autobiography, London, 1873, p.125
3. ibid., p.172

They only drew labour from other employments.[1] Simon Gray questioned only what he regarded as the anti-technology bias in Owen. He found Owen's views curious for one who was a manufacturer employing a large capital in machinery.[2]

Machinery Riots

The dispute over machinery took place on much more concrete levels than the hopes and threats of Owenism. The destruction of machinery was also a definite part of working class struggle in early industrial England. The critique of machinery was to remain an important part of working class ideology until well after Chartism and even, indeed, until the end of the Nineteenth Century.[3] The pre-industrial riot was characteristically the food riot, and was directed against the corn middleman.[4] But it was mechanization which took the centre stage from the late Eighteenth Century onwards. Machinery became the most immediate basis for the relationship between capitalist and worker. It was the machine which defined the organization of work and which held the balance of power in the determination of the distribution of returns from labour. More fundamentally, machinery threatened displacement of labour in a period of low labour mobility, no industrial retraining schemes, and no redundancy payment. The Luddite disturbances of 1811 to 1813 and 1816 were still fresh in the minds of the more paranoid members of the middle class. The machinery issue also provoked significant divisions within classes. William Cobbett, for example, took a stand against many of his fellow radicals on the Luddite question. His

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1. John Barton, An Inquiry into the Causes of the Progressive Depreciation of Agricultural Labour in Modern Times, London, 1820, p.77
2. George Purves, All Classes Productive of National Wealth or the Theories of M. Quesnai, Dr. Adam Smith, and Mr. Gray, London, 1817, p.301 (George Purves was a pseudonym for Simon Gray.)
3. See E. J. Hobsbawn, 'The Machine Breakers', Labouring Men, New York, 1967; Joy McAskill, 'The Chartist Land Plan', in Asa Briggs, ed., Chartist Studies, London, 1965; and Raphael Samuel, 'Introduction', R. Samuel ed., Village Life and Labour, London, 1975.
4. See E. P. Thompson, 'The Moral Economy of the English Crowd in the Eighteenth Century', Past and Present, 1964, 50, 1971, 78-9, and George Rude, The Crowd in History, New York, London, Sydney, Chapter two

'Letter to the Luddites' published in the Political Register in 1816 was reprinted in 1823. Here Cobbett had argued that there could be no solid objection to machinery in general. He accused writers 'on the side of corruption' of 'inculcating notions hostile to machinery as well as notions hostile to butchers and bakers'.

Cobbett went on to argue that the wages saved by the employment of machinery in one sector could be used to employ other labour in a different sector. He concluded his pamphlet with a threat of a loss of foreign trade if technical change was held back, and with blaming the burden of taxation for the distress.[1]

This was the pamphlet which provoked the already mentioned public reply from Ricardo. Unlike many of his middle class sympathizers, Ricardo, in debate in the House of Commons, said he was not satisfied with the reasoning of the pamphlet. It was 'evident, that extensive use of machinery by throwing a large portion of labour into the market, while, on the other hand, there might not be a corresponding increase of demand for it, must, in some degree, operate prejudicially to the working classes'. But he stressed he would not tolerate any law to prevent the use of machinery. If the county 'gave up the system that enabled /it/ to undersell in the foreign market, would other nations refrain from pursuing it? Certainly not.' They were bound by their own interest to continue it.[2]

The tory ministers saw the anti-machinery aspect of the reaction to distress as a political affair. Liverpool had admitted that in 1819 industrialization brought social problems. However, he believed the French Revolution was responsible for the democratic ideas which led to

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1. William Cobbett, 'A Letter to the Luddites', Cobbett's Weekly Political Register, London, 30 November, 1816.
2. 'Wages of Manufacturers - Use of Machinery', Hansard, ix, 30 May, 1823, 601

resistance to the effects of industrialization.[1] The 1826 riots in Lancashire posed the issue squarely. These riots took place in another year of crisis which had opened as a financial disruption. It was amid signs of increasing wealth in 1825 that the capital market collapsed. There had been a flurry of joint stock ventures and speculation, but the final crash in December, 1825 brought down forty-three county banks. Hilton has given a very compelling picture of the impact of the 1825 - 26 crisis on consciousness. He argues that the crisis left its mark on economic thought and literature by creating a gloomy preoccupation with business failures.[2]

One effect of this crash was a series of riots in the manufacturing districts in the early Spring of 1826.[3] The reaction to the riots was sharp.[4] Local newspaper editors who endorsed classical political economy wrote tracts on machinery to be distributed among the workpeople. The most well known of these were Archibald Prentice's 'On the Causes and Cure of the Present Distress' and Edward Baines' 'Letter to the Unemployed Workmen of Lancashire and Yorkshire'. Prentice's pamphlet blamed the depression on the currency, the corn laws, and excessive government spending.[5] Baines stressed the advance of continental industry, especially cotton manufacturing in Rouen. He predicted that the machine breaking at Blackburn would encourage manufacturers to leave the country and set up in France.

Baines' pamphlet was widely distributed and praised in government and industry. Lord Lansdowne wrote

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1. A. J. B. Hilton, 'The Economic Policy of the Tory Governments', p.86
2. ibid., p.250
3. The course of these riots has been described by Archibald Prentice, Historical Sketches ... of Manchester, Manchester, 1851, pp.274 - 276
4. See Hume's speech on the riots, Hansard, xv, 5 May, 1826, 910
5. Archibald Prentice, 'On the Causes and Cure of the Present Distress', Manchester Gazette, 15 July, 1826 and 22 July, 1826.

> 'It is seldom indeed that the subjects connected with the most important principles of political economy are discussed in a manner so calculated to make them acceptable to the understanding of the many.'[1]

Bannister Eccles, one of those Blackburn manufacturers whose mills had been attacked, thought Baines' pamphlet had done much good in the area by removing the prejudice against the power loom.[2]

The 'Address' was also the subject of a significant correspondence between Baines and Simonde de Sismondi. The correspondence is an interesting study of the confrontation of theory with the practical issues of the day, and depicts the interaction between a provincial industrial ideologue and an internationally known intellectual. Baines sent Sismondi a copy of the Address, which he regarded as a refutation of Sismondi's doctrines.[3] Sismondi took the opportunity of reply to reassert his underconsumptionist beliefs. He regarded 1826 as 'giving a fatal direction' to the efforts of a people to become the manufacturers of the world.[4] He objected, not to machinery, but to the unjust division of its products. He counselled Baines to look at the 1826 crisis in terms of the glut and the social organization of industry.

> 'This permanent and universal glut is absolutely inexplicable on the system of your economists Messrs. Ricardo, McCulloch etc., but it is in my opinion a necessary consequence of the direction industry has taken ... I have never dreamt of preventing by any law the improvement of machinery, nor even of discouraging ingenious men from the invention of new machines; all that I should wish is to render it impossible for the master manufacturers to extort from their workmen

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1. Lord Lansdowne to E. Baines, Sr., Baines Papers, 22 May, 1826. Also see letter from Byng, Commander of the Northern District to Baines Sr., 15 May, 1826, Baines Papers.
2. Bannister Eccles to Edward Baines, Jun., 22 June, 1826, Baines Papers.
3. Information on Baines and local politics can be found in Derek Fraser, 'Edward Baines', Pressure from Without, ed. Patricia Hollis, London, 1974.
4. J. C. L. Simonde de Sismondi to Edward Baines, Jun., 19 July, 1826, Baines Papers.

what they cannot obtain from the consumer.'[1]

McCulloch and Place took predictable stands on the riots. Both confronted the machinery issue of 1826 in the context of previous working class revolt. McCulloch thought popular ignorance of political economy was one reason for the opposition to technical progress.[2] He argued that the Lancashire riots would discourage investment and lead to further reductions in the demand for labour.[3]

The struggle of the working classes against the encroachment of machinery was an unending preoccupation to Francis Place. Over the years he had corresponded on the issue with trade associations, unions, and political groups. Not only the recent weaving riots, but the problems of the operative sawyers, the Frome woollen committee, newspaper printers, and paper makers gave him ample experience for a series of letters on machinery to the Bolton Chronicle of 1826.[4] Place simply repeated his old views that distress was not due to machinery, but to population increase.[5]

William Ellis' timely piece the 'Employment of Machinery', raised the level of debate by pointing out the significance of the timing of technical change. He argued that most new processes were introduced in times of prosperity, not in times of crisis.[6]

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1. J. C. L. Simonde de Sismondi to Edward Baines, Jun., 27 July, 1826, Baines Papers. I am in the process of editing this Sismondi - Baines correspondence for publication.
2. J. R. McCulloch, A Discourse on the Rise, Progress, Pecular Objects and Importance of Political Economy, Edinburgh, 1824, p.84
3. /J. R. McCulloch/, 'On Economic Distress and Pauperism', The Scotsman, 22 July, 1826.
4. See Place Collection of Newspaper Cuttings, vol.57, 1 - 60
5. Relevant copies of the Bolton Chronicle no longer exist. Place collected most of the letters in his Collection of Newspaper Cuttings, vol.16, 171 - 236
6. /William Ellis/, 'Effects of the Employment of Machinery Upon the Happiness of the Working Classes,' Westminster Review, v, Jan., 1826.

Political Economists

It is striking that over this period, the issue of machinery seldom failed to turn up in any tract on economics. The problems of crises, gluts and machinery were constantly in the air both on the level of practical politics and on the level of general theory. The particular political situations I have outlined here, that is, the recovery from the post Napoleonic depression, the confrontation with Owenite socialism, and the 1826 machinery riots came to be fitted into a general problematic. These particular events were, however, external focal points which both brought political economy into local and political life, and which redirected and influenced future developments in theory. Above all, this was a period when class connotations were not the clear ones of master versus workmen. Radical and reactionary visions were often similar, and 'honourable' masters often joined forces with insurrectionary artisans. The optimism behind the advance of the Industrial Revolution was not complacent. It was established in struggle against those who both looked to some alternative pattern of development, and sought control over the directions of technology. The heroic dream of technological inevitability met with a formidable opposition which deployed Sismondi, Malthus and their gentry followers with Owen, the radical weavers, and the small masters. This was, furthermore, only the most articulate form of dissent. Technological innovation was challenged in everyday struggle in the workplaces of most industries throughout this period. Workers and their trade unions were not ashamed to denounce the type of progress which brought redundancy and few aids to mobility, and which enforced higher labour productivity with inadequate compensation.

Such central difficulties of policy and social conflict moulded political economy in the 1820's into an essentially practical science.

Coupled with this, however, was the grip of the analytical traditions of Smith and Ricardo. Ricardo's Principles raised many problems in the years after it was written. Not least among these was the difficulty of understanding the status of, or the relationship between his twin interests in the analysis of the falling rate of profit, and in the optimistic growth prospects of western economies. Both the institutional arrangement of economics and the problems raised by Ricardo's Principles, which even in its own time was an intellectual tour de force, characterized this period as one of a wealth of dissident literature. This was not, as has been often believed, a period of the unequivocal ascendance of classical economics. Pressing practical problems and a real intellectual struggle with Ricardo's ideas prevented this.

The economics of these years does, however, take on some form which does distinguish it from the political economy of a decade later. As far as generalization is possible, it does seem that certain assumptions and concepts influenced the discussions of particular problems, such as the machinery issue. Investigation of ideas on technology during the period indicates a frame of reference dominated by the division of labour. A possible organizing principle for this is Marx's formulation of the phase of 'manufactures'. Marx defined this phase as one dominated by the hierarchical division of labour and by capitalist social relations. He also saw germinating within this phase the first emergence of the factory and machinery.[1] Marx's 'phases' can be seen as historical perceptions as well as logical constructions within his conception of capital. The political economy of the 1820's does seem to depict the focus of this historical phase of manufactures, but yet also contains the elements predicting movement beyond this. This political economy does reflect the

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1. Karl Marx, Capital, N.Y., 1967, i, Chap.xiv

structure of the early period of an industrializing economy. But it also acted on that structure by bringing growing consideration to concerns with machinery and the form of capital.

Several of the economists of the period were genuinely involved in the development and diffusion of Ricardo's ideas. Those particularly involved in this project were McCulloch, Ellis, and James and John Stuart Mill.

Ricardo's allies gave great publicity to the significance of the Ricardian achievement. James Mill and J. R. McCulloch both dwelt on the scientific character of Ricardian economics, and attempted to turn political economy into a fixed body of doctrine. McCulloch's Principles combined outright plagiarism of his master with an evangelism on the behalf of industry.[1] James Mill's Elements of Political Economy presented economics as a theory without qualification.[2] The early writings of John Stuart Mill in these years were also notably polemical, and he later referred to these as 'mere reproductions'.[3] Another of the Ricardian allies, William Ellis, was also a man of practical and doctrinal concerns. He was a member of Mill's Utilitarian Society, and though described as 'an original thinker in the field of political economy',[4] he himself recognized his real interests:

> 'In those discussions which we used to hold, the difference between John Mill and me was brought out very often. He was for enquiring into everything, and going to the bottom of everybody's theories and ideas; I cared only for the practical value of political economy and did not want to think deeply on points which could have no bearing on

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1. McCulloch's earlier and later writings were, however, much more Smithian. See D. P. O'Brien, J. R. McCulloch, London, 1970.
2. James Mill, Selected Economic Writings, ed. Donald Winch, London, 1966, p.188
3. J. S. Mill, Autobiography, London, 1873, p.119
4. ibid., p.81. Ellis' role in popular political economy and in the Birkbeck Schools have been recounted by R. Gilmour, 'The Gradgrind School: Political Economy in the Classroom', Victorian Studies, xi, December, 1967, pp.213 - 218

social affairs and human conduct.'[1]

Ellis expressed these practical concerns in the main pieces he wrote for the Westminster Review: 'Charitable Institutions' (1824), 'Exportation of Machinery' (1825) and 'Effects of the Employment of Machinery on the Happiness of the Working Classes'. (1826)

These followers of Ricardo were challenged by a series of critics. Dissent and intent to develop new theories were developed by Robert Torrens in his work on value and technical progress, by Hopkins on rent, and by a range of anonymous writers on the impact of increases in labour productivity.[2] These critics were complemented by the underconsumptionists, Thomas Chalmers, T. R. Malthus, and Simon Gray.[3] British economists of the period also paid significant attention to the work of two foreign critics - J. C. L. Simonde de Sismondi and J. B. Say. Sismondi and Malthus were frequent correspondents, and Ricardo, though not impressed with Sismondi's political economy, did hold him in generally high regard.[4] J. B. Say was

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1. Cited in E. K. Blyth, Life of William Ellis, London, 1892, p.40
2. Robert Torrens, An Essay on the Production of Wealth, London, 1821; Samuel Bailey, A Critical Dissertation on the Nature, Measures and Causes of Value, London, 1825; John Barton, Observations on the Circumstances which Influence the Condition of the Labouring Classes of Society, London, 1817; Thomas Hopkins, On Rent of Land and its Influence on Subsistence and Population, London, 1828; /Anon./, An Essay on the Political Economy of Nations, London, 1821.
3. Simon Gray, The Happiness of States or an Inquiry Concerning Population, London, 1815; George Purves (pseud.), All Classes Productive of National Wealth, London, 1817; Thomas Chalmers, An Enquiry into the Extent and Stability of National Revenue, 1808, On Political Economy in Connexion with the Moral State and Moral Prospects of Society, 1832, and On the Christian and Civic Economy of Large Towns, 3 vols., Glasgow, 1821 - 1826 Chalmers was a prolific writer who saw his life's work as the unification of religious doctrine and laissez faire economic theory. See R. M. Young, 'Malthus and the Evolutionists', Past and Present, No.43, 1967, pp.120 - 121
4. J. C. L. S. de Sismondi, De La Richesse Commerciale, and Nouveaux Principes d'Economie Politique, (2nd edn.), Paris, 1827. Ricardo's opinions on Sismondi can be found in letters to McCulloch, 7 April, 1819, Letters 1819 - 1821, Works, viii, 22; to Mill, 6 Sept., 1819, ibid., 57; to Mill, 17 Sept., 1822, Letters 1821 - 1823, ix, 218; to Trower, 14 Dec., 1822, ibid., 244.

an honorary member of the Political Economy Club, and was also known for his notes on the French translation of Ricardo. He corresponded frequently with Ricardo and was one of his most consistent critics on value. Say had also worked in England as the manager of an assurance firm, then as one of Napoleon's industrial informants, reporting on English factories and techniques.[1]

Debate in the 1820's was dominated in the first instance by those Ricardian problems of value and the role of effective demand. Dispute also gathered momentum over the question of agriculture and labour productivity. Questions such as these prompted the successors of Ricardo to return to the Smithian concern with the division of labour. From a reassertion of the gains from the division of labour, economists went on to describe in greater detail the origins of capital and machinery, and the sources of investment. A background of analytical and empirical investigation into these areas helped to give greater force to opinions on machinery and labour, which were continually reasserted over the period.

Value

There was great debate, but little advance on the value question after Ricardo's death. The labour theory of value which was only an analytical tool in Ricardo's hands, took on a certain moral and mystical significance in the debates of his contemporaries and successors. One group of critics was concerned to see the labour theory of value as a symbol that labour

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1. Say sent questions to the Political Economy Club as noted in Political Economy Club, Centenary Volume, vi, 11, 16. Ricardo similarly was unimpressed ... ... both with Say's Notes Explicatives on his own Principles and with the Letters to Mr. Malthus ... on the Stagnation of Commerce, London, 1821. See Ricardo to Mill, 23 Dec., 1818, Works, vii, 378; Ricardo to Mill, 9 Oct., 1820, viii, 276.
   At any rate the idea of the Notes prompted his own Notes on Malthus. See P. Sraffa, 'Introduction', Notes on Malthus' Principles of Political Economy, Works, ii.
   Say's business life is detailed by G. Koolman, 'Say's Conception of the Role of the Entrepreneur', Economica, 1971.

was the great cause and ultimate foundation of all wealth. Another wished moral recognition to be given to the capitalist and the landlord.

Say joined forces with Malthus and Torrens to continue to demand a capital theory of value. Ricardo had responded to this much earlier by asking how Torrens intended to measure capital, and by reminding Malthus that equal capitals did not yield equal values.[1] Malthus, however, returned to comment on the unsatisfactory nature of the labour theory of value, and noted that the qualifications which Ricardo had accepted were so numerous that the 'rule may be considered an exception, and the exception the rule'.[2] This was only a gloss on Bailey's earlier demand, 'why attempt to give the science an air of simplicity which it does not possess?'[3] Say stressed the role of the entrepreneur and his profit as a part of the cause of value.[4] Torrens, at least, attempted to reformulate his capital theory of value in response to Ricardo's criticism. What he substituted, however, was a very contrived 'accumulated labour' theory of value.[5]

This attempt to give precedence to the modifications of the labour theory of value was matched by the equally dexterous manoeuvres by both

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1. David Ricardo, Notes on Malthus' Principles of Political Economy, Works, ii, ed. Sraffa, p.75
   Also see D. Ricardo, 'Absolute Value and Exchangeable Value', p.393
2. T. R. Malthus, Definitions in Political Economy, London, 1827, p.27. Malthus' answer to Ricardo's Notes on his Principles was a badly organized pamphlet, The Measure of Value Stated and Illustrated, London, 1823, which only reasserted his position that value was determined by profits as well as by accumulated and immediate labour.
3. Samuel Bailey, Critical Dissertation on Value, London, 1825, p.217
4. J. B. Say, Notes Explicatives et Critiques, Des Principes de L'Economie Politique et de l'Impot par M. David Ricardo, Paris, 1819, p.9 and J. B. Say, A Treatise on Political Economy, (fourth edition), London, 1821, and Vol.I, p.404
5. See Lionel Robbins, Robert Torrens and the Evolution of Classical Economics, London, 1958, pp.61 - 69. See Torrens' early work on value in 'Strictures on Mr. Ricardo's Doctrine Respecting Exchangeable Value', Edinburgh Magazine, N.S. iii, October, 1818, pp.335 - 338

McCulloch and Mill to keep the labour theory in all its purity. Mill and McCulloch denied the qualifications admitted by Ricardo. They described natural processes such as the aging of wine as a form of labour, and described profits as the wages of stored up labour.[1] McCulloch was one of those who attached a certain mystique to the labour theory of value,

> 'Labour is the talisman that has raised him from the condition of the savage - that has changed the desert and the forest into cultivated fields ... that has given us plenty, comfort and elegance, instead of want, misery and barbarism.'[2]

Ricardo, however, remained unconvinced by all this word juggling. On the day he was struck fatally ill, Ricardo wrote to James Mill of his disagreement with these views in a paper by John Mill.

> 'My principle objection against John is that he proposes to prove that commodities are valuable in proportion to the quantity of labour expended on them, and then proves that capital is another name for labour; profit a name for the wages of labour; and therefore, commodities are valuable in proportion to the wages of all descriptions paid for the production of them ... Capital enters into value otherwise than labour in a particular form, and is paid at a different rate with immediate labour ... John does not allow for profits increasing at a compound rate'.[3]

One of the few definitely novel stands taken on the value question

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1. J. R. McCulloch, Principles of Political Economy, Edinburgh, 1825, pp.313 - 319; and 'Review of Malthus' Definitions in Political Economy', Edinburgh Review, 1827. Also see James Mill, Elements of Political Economy, London, 1821. The value problem was taken up on numerous occasions in the Political Economy Club. Say, Torrens, and Senior all posed questions of value at meetings over 1822 and 1823. See Minutes of the Political Economy Club, Centenary Volume, vi, pp.15 - 16, 19, 20
2. J. R. McCulloch, Principles, p.71
3. Letters 1821 - 1823, Works, ix, Ricardo to James Mill, 5 Sept., 1823, p.387. Also see Ricardo's comments on McCulloch
   'you go a little farther than I in estimating the value of commodities by the quantity of labour required to produce them: you appear to admit of no exception or qualification whatever, whereas I am always willing to allow that some of the variations in the relative value of commodities may be referred to causes distinct from the quantity of labour necessary to produce them'.
   See Ricardo to McCulloch, 19 March, 1822, p.178

during these years was the dismissal of the significance of Ricardo's search for an invariable standard of value. J. B. Say, a few years earlier, denied the possibility of a consistent measure of value, and showed remarkable unconcern with what he used as a surrogate.[1] It was Bailey, however, who demanded a break with the entire theoretical apparatus. He denied not only the practical, but the conceptual possibility of an invariable standard.[2] The search for an invariable standard was, in Torrens' words, like 'that of the alchemist in search of the philosophers' stone'.[3] In Bailey's view, there was henceforth no need for a standard.

The primary concern among these economists was to describe the path to long run stable growth. The moral attributes attached to theories of value derived from this passionate search for the sources of growth. Productivity became the issue of the day. But surprisingly, it was an issue that was analyzed within the terms of the old debates. The questions posed were the old ones of productive and unproductive labour, and the determinants of wages and population. The new discussion generated by these conventional issues drove theorists back to the analysis of the division of labour.

Productive and Unproductive Labour

Productive and unproductive labour were Eighteenth Century categories devised by the physiocrats and adapted by Adam Smith. The categories continued to be used by the early English underconsumptionists, and filtered down into the work of the later underconsumptionists, Chalmers and Malthus. Most of these theorists identified agriculture as the most productive of

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1. J. B. Say, Notes Explicatives, i, pp.12 - 13
2. /Samuel Bailey/, 'A Letter to a Political Economist Occasioned by an Article in the Westminster Review on the Subject of Value', London, 1826, p.15
3. Torrens' third edition of his An Essay on the External Corn Trade, London, 1826, p.xii, hailed Bailey's Dissertation on the Nature, Causes and Measures of Value.

enterprises. Malthus, in fact, ranked the productivity of sectors according to the surplus produced by the labour employed in the sector. He ranked agriculture first because he believed that the labour here generated sufficient surplus to replace wages, profits and rent. The industrial sector ranked second because it generated only wages and profits.[1] Most of the economists of the 1820's, however, subscribed to the broader categories described in Colquhoun's popular Wealth, Power, and Resources of the British Empire, of 1815. Colquhoun described as productive labourers all those in trade, manufacturing and agriculture who in some way added to wealth. Unproductive labourers added to the value of nothing, though they might include many useful labourers.[2] As has been pointed out, even Ricardo made use of the distinction by attempting to separate the source of additions to net revenue from additions to gross revenue.[3] Political economists assumed that growth was generated by shifting resources from unproductive to productive sectors. Within these sectors, higher productivity was related to the incentives of high wages and the intensification of labour. Economists gave new attention to the technical attributes of labour. The pace, discipline, and skill with which work was done was the key to higher productivity and a nationally superior technology. These ideas grew out of the sensitive work done by many economists during this period on the determinants of wages and labour

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1. T. R. Malthus, Principles of Political Economy (1820), Works, ed. P. Sraffa, ii, 20; and Thomas Chalmers, On Political Economy in Connexion with the Moral State and Moral Prospects of Society, Glasgow, 1832, Reprint 1st ed., New York, 1832, p.2
2. P. Colquhoun, A Treatise on the Wealth, Power, and Resources of the British Empire, London, 1814. The broadening of the categories had indeed been attempted before by both James Mill, in Commerce Defended, and Robert Torrens in The Economists Refuted, 1808 in their critiques of Spence.
3. The only theorists who tried to break completely with the unproductive - productive categories was the little known demand theorist, Simon Gray. He upheld the vital role of the 'circulators', and tried to show that in this sense all classes were productive. See Simon Gray, Happiness of States, London, 1815, p.55

supply, in other words, the population question.

Population and Wages

Though Malthusianism was to receive its greatest censure in the next decade, there was a good deal of anti-Malthusianism in these years. Even if discussion is confined to middle class theorists, it is easy to find a wave of revulsion against the doctrine. As already noted, Ricardo's position on this was ambivalent. Malthus' own adamant defence of his doctrine was probably reinforced by his fears of the urban horde.

> 'Late events must make us contemplate with no small alarm a great increase in the proportion of our manufacturing population, both with reference to the happiness, and to the liberty of our country.'[1]

It is interesting to note that Malthus' political fears were redirected by another who wrote under the pseudonym McIniscon. According to this writer, the 'antipopulationists' were politically diversionary. The real efforts were to be made against those who destroyed capital or those who 'offer unnatural excitements' to the increase of people, 'which two causes can alone induce redundancy of population.'[2]

Sismondi, in particular, was very suspicious of the crude 'Malthusian tendencies'. He hailed the empirical work of John Barton on population movements.[3] Barton's work on population was probably the most interesting of the period. Barton challenged the assumptions of political economists that the supply of labour was flexible and that labour was a perfectly mobile factor of production. His close statistical work showed that there

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1. Malthus, Principles, p.205
2. John McIniscon (pseud.), Principles of Political Economy and Population, i, London, 1825, p.86. [i.e.J. C. Ross]
3. Sir Thomas Sowell, 'Sismondi: A Neglected Pioneer', Hist. Pol. Econ., 4, Spring, 1972, p.82. Also see Sismondi's enthusiastic review of Barton in Annales de Législation et d'Economie Politique, November, 1822.

was no direct evidence that wage rates influenced birth and death rates. The motivation of the labourer was determined by 'custom' rather than abstract reasoning. Marriage decisions were influenced not by income, but by employment prospects. Barton accounted for the recent rise in population, however, by a completely exogenous factor - improvements in health and medicine. Barton also shattered the accepted identity between population and labour supply. The creation of an adult labourer was a long term process. Between an increase in population and an increase in the active labour force lay long years of maturing, socializing, skill acquirement, and apprenticeship.[1]

Not only were the Malthusian crudities on the determinants of population growth unacceptable to many of his contemporaries, but so also were his generally pessimistic attitudes to the impact of population growth. Simon Gray's work, for instance, was reminiscent of those Eighteenth Century views which elevated population growth as a permanent source of wealth.[2] A rising population increased wants and changed customs. It caused an 'active circulation', and introduced ingenuity and the division of labour.[3]

Critical shafts such as these certainly hit main line theorists. Some, such as Ricardo, Torrens and Senior were already sensitive to the role of custom and the social determinants of subsistence levels.[4] Soon even

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1. John Barton, Observations, pp.41 - 43. Also see his Inquiry into the Causes of the Progressive Depreciation of Agricultural Labour in Modern Times, London, 1820, pp.22 - 29
2. See A. W. Coats, 'Changing Attitudes to Labour in the Mid-Eighteenth Century', Economic History Review, xi, No.1, 1958, pp.43 and 46
3. Simon Gray, The Happiness of States, pp.321 - 324
4. See D. Ricardo, Principles, Chapter V, 'On Wages'; Robert Torrens, An Essay on the External Corn Trade, London, 1815, p.62. Senior drew attention to the connection between the progress of wealth and the consumption patterns of workers. As workers came to consume more manufactured goods, the cost of employing them fell. See [N. Senior], 'Report - on the State of Agriculture', Quarterly Review, xxv, July, 1821, pp.469 - 470

McCulloch, after reading Barton, was moved to reject Malthusianism, and even went so far as to argue that population pressure was necessary to growth.[1]

Though Malthus believed there would be a tendency to low wages because of population growth, his attitudes were quite different. Both Ricardo and Malthus, along with most contemporary writers on political economy condemned the cry of manufacturers and merchants for low wages.[2] Most agreed that high wages were conducive to high productivity. McCulloch depicted very well the character of this dual belief in high wages and in the Malthusian population theory.

> 'No country can flourish, if the necessary rate of wages be low; nor can it long be depressed, if the rate of wages be high. Labourers are the sinews of agriculture, of manufactures, of commerce; it is by their labour that our machines are constructed and set in motion; it is by their ingenuity, frugality, and perseverance, that we have become what we are ... so long as the standard of REAL WAGES is high, and it in their own power to keep it so, so long will the social fabric be stable. But if the standard of REAL WAGES be permanently reduced, and it must be their own fault if it be reduced, if by an improvident increase of their number they be once brought to place their dependence on ... the mere necessaries of life, ... The spirit of industry by which they are so eminently distinguished will be destroyed, and with it the morals, the prosperity and the tranquillity of Britain.'[3]

The apparently religious enthusiasm for high wages, and the crucial role of labour depicted in the first part of this passage was typical of the style of mystical exultation of the role of labour in growth and technological transformation.

> 'The world is the theatre of labour, and labour is the origin of wealth, and the most certain and salutary

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1. D. P. O'Brien, J. R. McCulloch, p.318
2. T. R. Malthus, Principles, ed. Sraffa, Works, ii, p.220. Also see Ricardo's note on this page.
3. [F. Place], Notes of Mr. McCulloch's Lecture on the Wages of Labour and the Condition of the Labouring People, London, 1825, p.15

preventive of poverty, wretchedness and disaffection.'[1]

High wages could produce a capital intensive bias, or as McCulloch put it, a country with high wages and low profits would produce machine made goods much cheaper.[2] Such an analysis was indeed topical. It 'sets the impolicy of the restrictions on the exportation of machinery used in cotton-mills in a very striking point of view'.[3]

The productivity of labour was increased by technical skill, 'the useful arts', 'the faculty of labour'.[4] Indeed, wage levels reflected skill requirements. Theorists made the connection between dilution and the new employment possibilities for women and children. One of these, Thomas Hopkins, devised a scale of wage differentials ranging from weaver to machine maker. Wages in weaving were low because of a widening labour market. The trade demanded little skill, as apprenticeship regulations broke down, and it offered remunerative employment to women and children. Highest wages went to the fully qualified machine maker because the trade restricted its labour market by offering little for the labour of learners during the long years of apprenticeship. Few could afford to put their children in such occupations with only the expectation of eventual high returns.[5]

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1. See W. R. A. Pettman, An Essay on Political Economy, Part I, 1828, p.72 For similar views see (Anon.), An Essay on the Political Economy of Nations, London, 1821, p.30
   Pettman was a captain in the British Navy in the 1820's. See R. D. C. Black 'Parson Malthus, The General and the Captain', Econ. Jrl. lxxvii, March 1967 for discussion of some of his underconsumptionist views.
2. [J. R. McCulloch], 'Rise Progress, Present State and Prospects of the British Manufacture', Edinburgh Review, xlvi, June, 1827, pp.30 - 31
   A similar point was made by the author of (Anon.), A Few Observations on Some Topics of Political Economy, London, 1825.
3. J. R. McCulloch, Principles, p.323
4. These are the words of the author of (Anon.), An Essay on the Political Economy of Nations, London, 1821, p.35
5. Thomas Hopkins, Economical Enquiries relative to the Laws which Regulate Rent, Profit, Wages and the Value of Money, London, 1822, pp.58 - 60

The Division of Labour

Associated with this search for the sources of higher labour productivity went an interest in wider aspects of the division of labour. Smith was again in the fore. Torrens, first in The Economists Refuted, and again in his later work, reminded his readers of the dialectic worked out by Smith between technique and market. The 'expectation of exchanging gives rise to divisions of labour.'[1] McCulloch expressed the same ideas in terms of the 'facility of exchange' which acted as the 'vivifying principle of industry'.

> 'Like the different parts of a well constructed machine, the inhabitants of a civilized country are all mutually dependent on and connected with each other.'[2]

Free trade was a source of invention. It extended business, and it would 'diffuse a greater, a more extensive, a more emulous, and a more successful spirit of active industry'.[3]

Again, Smith's remarkable theories of the relationship between town and country in Book III of the Wealth of Nations found their way into Torrens' theories of interdependent growth in agriculture and industry.[4] The novel feature which Torrens did add was a distinction between the mechanical and the territorial divisions of labour. To the original mechanical division of labour corresponded a vast regional and global differentiation. The real measure of the gains from trade was the degree to which foreign divisions of labour increased the productivity of labour.

Unlike Torrens, McCulloch was not at all interested in balanced growth. It is true that he did take a Smithian view of the division of labour and accumulation acting and reacting on each other to lead to the invention of

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1. R. Torrens, The Economists Refuted, London, 1808, p.17
2. J. R. McCulloch, Principles, p.90
3. W. R. A. Pettman, An Essay on Political Economy, Part I, London, 1828, p.71
4. R. Torrens, An Essay on the External Corn Trade, (third edition), London, 1826, pp.44, 45

machinery. But McCulloch hinged Britain's future progress firmly on the development of manufacturing industry. He detested the domestic system,

> 'I consider the combination of manufacturing and agricultural pursuits, to be proof of the barbarism of every country in which it exists; and so far from its being advantageous to the country, I think it decidedly the reverse.'[1]

He was completely derisive of schemes to introduce a 'cottage economy'. The great cause of the improvement of society was the division of labour and this could not be properly introduced in such systems because few surplus goods were produced for exchange. In such systems it would be impossible to 'realize capital'.[2] McCulloch looked to the machine making sector as well as the manufacturing sector as fundamental, even to the development of agriculture. He emphasized the labour of the ploughwright, millwright, smith, and other artizans preparing the tools of the farmer as manufacturing labour which was crucial to agriculture.[3] The indefinite extension and improvement of machinery were the companions of the continued and indefinite improvement of the skill and industry of labour.[4]

Despite the great enthusiasm of theorists in this period for the Mechanics' Institutes, McCulloch was one of the few who explicitly connected education to his theory of invention. He proposed that there be a cordial reception for foreigners who brought technical improvements or skills with them.[5] He saw the acquisition of talent and skill as an actual capital investment. The entire success of the cotton industry was to be attributed to the discoveries and inventions of Hargreaves, Arkwright and Watt.

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1. Quoted in D. P. O'Brien, J. R. McCulloch, p.283
2. /J. R. McCulloch/, 'On Cottage and Agrarian Systems', The Scotsman, March 1, 1871, p.41
3. J. R. McCulloch, The Principles of Political Economy, London, 1825, p.147
4. /J. R. McCulloch/, 'Effects of Machinery and Accumulation', Edinburgh Review, xxxv, March, 1821, p.104
5. See D. P. O'Brien, J. R. McCulloch, p.280

McCulloch, however, added another meaning to skill. Skill, as Smith had argued, was 'expertness in manipulation and in the details of various processes [which] can only be attained by slow degrees.' Skill was also defined, however, as 'industrious habits'.[1] This very significant addition to the meaning of skill, as the latter part of this thesis will indicate, also pervaded the Mechanics' Institute Movement. McCulloch had great hopes for the Lancaster and Bell schools and for the Mechanics' Institutes.[2]

Very few made the connection between the division of labour and concentration. One writer who did notice the scale of firms and the tendency towards the concentration of capital was the anonymous author of the Essay on the Political Economy of Nations. He observed that as the division of labour advanced, there was a tendency towards the industrial integration of capital.

> 'It is observable that in the cotton manufacture, capital often tends to concentration: the importation of the raw material, spinning, weaving, finishing, exporting of the wrought commodity all taking place by the same capitalist ... It is division of labour but union of capital.'3

One logical forum for the discussion of the division of labour was inquiry into the role of the entrepreneur. It is surprising how little overt discussion there was among English theorists in these years of this 'labour' of the capitalist. It was only Say who made the entrepreneur a key part of his system. Say defined the entrepreneur as someone who was master of all that was known in a particular branch of industry, and who had collected

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1. J. R. McCulloch, 'Cotton', Dictionary of Commerce and Commercial Navigation, London, 1832, p.419
2. McCulloch, The Principles of Political Economy, pp.117, 118
   cf. Robert Torrens, Essay on the External Corn Trade, (third edition), p.201, who described skill as a form of 'moral capital'.
   See a similar argument in Essay on the Political Economy of Nations. If a 'considerable industry' was 'superseded', 'the faculty of labour remains to the workpeople, but their skill is eclipsed.' p.133
3. [Anon.], An Essay on the Political Economy of Nations, p.51

the requisite capital and labourers. And he attributed commercial success in Great Britain to the 'wonderful practical skill of her adventurers' in the application of knowledge.[1]

Prinsep, the translator of Say's Traité, in fact, found it difficult to translate the word entrepreneur. He decided on the word 'adventurer' to describe the person who took on himself the immediate responsibility, risk and conduct of a concern.[2] Say argued that the technical skill necessary to the entrepreneur could only be gained in the practical pursuit of the occupation concerned. In most industries there was a need for repeated experiment attended by more or less risk. This risk had to be borne by the entrepreneur.[3] He justified entrepreneurial income as a return for the moral qualities required, for the necessity of insuring an enterprise had capital, and for undertaking the risks and hazards associated with enterprise. The entrepreneur was, therefore, drawing in three incomes: a wage payment, interest on capital, and a premium for risk.[4] Say criticized Smith for neglecting the difference between profits of superintendence and profits on capital. The profits of the labour of superintendence were dependent on skill, activity, and judgement. The profits on capital were dependent on scarcity of capital and security of investment. Since the manager of a firm rarely borrowed all his capital, he was entitled to one portion of his revenue as manager and to another as capitalist.[5] Most of the English writers took the entrepreneurial function for granted as an initial condition for the accumulation of fixed and circulating capital. A few commented on the role of 'supervision' and

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1. G. Koolman, 'Say's Conception of the Role of the Entrepreneur', Economica 38, August, 1971, 272
2. J. B. Say, A Treatise, i, 41
3. ibid., pp.55 - 56
4. G. Koolman, 'Say and the Entrepreneur', pp.277, 278
5. J. B. Say, A Treatise, ii, pp.102 - 106

'direction', but most showed greater interest in the factors influencing decisions to invest and not decisions to innovate.[1]

The economic division of labour was also closely bound up with the social division of labour. Sismondi argued that the division of labour gave rise to a group in society that abandoned manual labour to study the means of controlling the forces of nature. I will say more of ideas about the role of science at a later point. But this social division of labour was also made manifest in the origins and emergence of the particular divisions of income. Sismondi identified these as fixed capital, circulating capital, and the revenue of capitalists. The worker, according to his system, had little opportunity for saving. It was only the capitalist who possessed consumer goods, primary materials, and machinery. He put these out to work for him and as compensation received the greater part of the fruits of labour - the profits of capital. The poor had only their labour for revenue and were dependent on a superior class to make that labour effective.[2]

Say, too, drew attention to the social impact of the social and economic division of labour. He was interested in the alienation of the worker and his loss of political power with the advances of the division of labour. He argued that the worker's incapacity for anything but one occupation rendered him less powerful to enforce his right to an equitable portion of the gross value of production.

> 'The workman, that carries about with him the whole implements of his trade, can change his locality at pleasure, and earn his subsistence wherever he pleases:

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1. See Anon., An Essay on the Political Economy of Nations, p.33. See Thomas Hopkins, Wages: or, Masters and Workmen, Manchester, 1831, pp.7 and 27, where he argued in England capitalists often kept management in their own hands. But the management function was to be seen as labour, and all reward for it as for personal service.
2. J. C. L. Simonde de Sismondi, Nouveaux Principes d'Economie Politique, (second edition), Paris, 1827, i, p.87

> in the other case he is a mere adjective, without individual capacity, independence or substantive importance, when separated from his fellow labourers; and obliged to accept whatever terms his employer thinks fit to impose'.[1]

Smith's analysis of the division of labour was in effect revitalized and extended during these years. The division of labour was increasingly associated with labour discipline, industrial concentration, and the subordination of the labourer to the subjective framework of the entrepreneur and capitalist.

The Land

This interest in the division of labour was parallelled by great concern over the prospects of the agricultural sector. Economists, in fact, sought to apply their new ideas on the division of labour to the agricultural sector. Much of this work was again based on a misunderstanding of the logical framework of Ricardo's theory of diminishing returns and an extreme interpretation of his attitude to landlords.

Malthus and Chalmers may have had a gloomy vision of the tendency to over-population and the general glut, but it was they, significantly who gave the greatest coverage to technical progress in agriculture. Chalmers argued that agricultural labour became more efficient with the intervention of tools of husbandry. It was

> 'not a matter of hunger and necessity enforcing the cultivation of new regions, but of the triumph of new energies and acquisitions seeking to subdue new territory and get equal subsistence from it.'[2]

Malthus believed that rising rents required agricultural improvement, and conversely that improvements would bring advantages to landlords on the renewal of leases.

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1. J. B. Say, A Treatise, i, p.88
2. Thomas Chalmers, On Political Economy, p.7. Though written in 1832, this text brought together Chalmers views of the 1820's on political economy.

> 'To the honour of the Scotch cultivators it should be observed, that they have applied their capitals so very skillfully and economically, that at the same time that they have prodigiously increased the produce, they have increased the landlord's proportion of it.'[1]

Malthus also impressed Ricardo with a perceptive comparison between the soil and machinery. He clearly distinguished the mechanisms of technical progress in agriculture from those of industry.

> 'The great inequality in the powers of the machinery employed in producing raw produce, forms one of the most remarkable features which distinguishes the machinery of the land from the machinery employed in manufactures ... Every extensive country may thus be considered as possessing a gradation of machines for the production of corn and raw materials ...'[2]

Malthus and Chalmers defended the prospects of a protected agriculture. Torrens did not. His optimism was based on the prospects of agriculture in an open economy. Throughout the whole period he defended the most forward looking ideas on agricultural change. In the second edition of his Essay on the External Corn Trade, he conceded that agricultural protection would increase rents, but only temporarily. Any cutback on profits caused by rising food prices would lead to the export of capital and, therefore, limit expansion of the manufacturing sector. This would stop local accumulation and progress, and would ultimately have adverse repercussions on landowning interests. Torrens also made the very 'adventurous' proposal that the import of foreign corn, by making marginal corn production unprofitable, would raise the profitability of producing luxury food products. Thus free trade and economic progress could not but

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1. T. R. Malthus, Principles, Works, ii, 159. Malthus' authority here was John Sinclair's Account of the Husbandry of Scotland.
2. Malthus, Principles, p.168. See Ricardo's note on this, p.169. Hopkins, too, made use of the analogy to argue the development towards peak productivity on a piece of land, and diminishing returns after that point. See T. Hopkins, Economical Enquiries, pp.31 - 33

raise the landlord's income.[1]

At a surprisingly early period, Torrens also introduced the conception of high farming. In disputing with Owen he argued:

> 'If our improved machinery did not tend to reduce the expense of producing manufactured goods, we could neither sell our fabrics in the foreign market, nor keep our inferior lands under cultivation ... A reduction in the value of manufactured goods, which allows lands of an inferior quality to be taken in, also admits of the additional application of capital to our better soil, and promotes that system of high farming for which England is so conspicuous. Were it not for the application of that scientific power and improved machinery, to which Mr. Owen erroneously attributes our distress, the whole of our foreign trade would be annihilated, and our tillage reduced one half.'[2]

A few years later, Torrens spoke of high farming as synonymous with heavy capital investment in the soil. If such farming was undertaken, the cultivator had to be left with a reasonable return, so that during the period of such investment, the landlord would have to be satisfied with lower rents.[3] Torrens also went as far as identifying farm size as a possible method of technical innovation. Larger farms allowed for the use of better agricultural machinery, such as threshing machines; they allowed for a longer marketed surplus, and could pay a proportionately higher rent. Landlords would be prompted to let their whole estate to fewer farmers, which meant smaller farmers would sink to agricultural labourers.

> 'the employment of more efficacious machinery, and the more economical application of labour, which are found admissable into large concerns, and which enable the great farmer to tempt the proprietor with the offer of a higher rent, would also enable him, ... , to raise a greater produce than before'.

Small farmers, though reduced to farm labourers would probably gain a greater

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1. See Lionel Robbins, Robert Torrens, p.46
2. /Robert Torrens/, 'Mr. Owen's Plans for Relieving the National Distress', Edinburgh Review, October, 1819, p.469
3. R. Torrens, An Essay on the Production of Wealth, London, 1821, p.116

subsistence than previously.[1]

This fascination with the potentiality of technical progress in agriculture did not, however, convince the theorist who was later to become the most influential. John Stuart Mill continued to believe, as an empirical fact, that agricultural improvements could have no permanent impact.

> 'The improvements which have been introduced into agriculture are so extremely limited, when compared with those of which some branches of manufactures have been found susceptible; and they are, besides, so very slow in making their way against those old habits and prejudices, which are perhaps more deeply rooted among the farmers than among any other class of producers, that the progress of population seems in most instances to have kept pace with the improvement of cultivation ... It has not, hitherto, indeed been at any time the effect of an improvement to drive capital from the land, nor consequently to lower rent.'[2]

The Origins of Capital and Machinery

There was great exploration in this period of possibilities for increasing total wealth by raising the productivity of labour through greater skill, better organization and division of labour, higher real wages, and the development of the agricultural sector. All of this, however, became background for a simultaneous and progressively dominant analysis of capital accumulation and the impact of machinery.

If one part of the conception of technical change in this period was the role of skill and the division of labour, then equally important was a novel perception of the origins of capital and machinery. Capital accumulation was a process which appeared to accompany the progress of civilization and the division of labour. Industrial growth brought greater

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1. R. Torrens, An Essay on the Production of Wealth, London, 1821, p.140
2. J. S. Mill, 'The Nature, Origin, and Progress of Rent', (1828), Essays on Economics and Society, Collected Works, iv, Toronto, 1967, p.177

security, and created the stable foundations for the creation of a capital market.[1] It was widely assumed, but only occasionally made explicit, that private property, especially in human industry and capital were sacred to the creation of wealth.[2]

Say and McCulloch regarded capital as a broadly conceived set of expedients for forcing into the service of man, a variety of natural agents. As noted earlier in this chapter, the labour market and education were recognized as aspects of capital formation. The sums spent on rearing a worker were consumed in a reproductive way, and education yielded an interest payment independent of the ordinary profits of industry.[3] Though the development of labour productivity was an aspect of capital formation, the introduction of machinery constituted a sharp break from the general division of labour. McCulloch, in fact, chastised Smith for giving all his attention to the division of labour, and neglecting the breakthrough constituted by machinery.[4] Mechanization did not simply flow from the division of labour. The very structure of capital prevented this. Capital and labour were inflexible. Mechanization required high capital investment, labour was immobile, and patents or other forms of restriction prevented sudden mechanization.[5] Entrepreneurs themselves were slow to move from

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1. J. B. Say, A Treatise, i, pp.128 - 129. Few theorists in this period distinguished decisions to save from decisions to invest. One who did, William Ellis, rejected the fixed fund analysis of many classicals and argued that fresh savings were induced by the expectation of greater profits. See W. Ellis, 'Employment of Machinery', Westminster Review, January, 1826, p.116
2. J. B. Say, A Treatise, ii, 22, cf. T. Hopkins, Economical Enquiries, p.67
3. J. B. Say, A Treatise, ii, 102 - 6, 92. McCulloch, Principles, p.112 - 119
4. J. R. McCulloch, 'On the Effects of the Employment of Machinery Manufacturing', The Scotsman, 19 April, 1817, p.97
5. J. R. McCulloch, 'On Cottage and Agrarian Systems', The Scotsman, 1 March, 1817, p.41

industries where they had gained their habits, experience and talent.[1]

Economists now asserted that the origins of machinery were not even historically contingent on the division of labour. Torrens argued that the existence of capital could be traced back to the very earliest of times. Manufacturing industry did not follow agriculture, in the pattern of the Eighteenth Century stages. That is, development from hunting and gathering to agriculture and from there to manufacturing and commerce. Rather it actually succeeded the phase of appropriative industry or hunting and gathering. During the progress of improvement while capital continued to accumulate and population to increase, there could be no limits on the power of manufacturing industry. The accumulation of capital allowed any work done to be divided and subdivided until each individual acquired a degree of dexterity and skill unattainable in small establishments.[2] The employment of machinery if only in manufacturing industry alone, would have great repercussions on the agricultural sector, by lowering the cost of the farmer's outlays. Torrens' technological imagination was also farseeing. He foresaw steam replacing all horses on 'all the great lines of traffic', and it was not improbable that 'plough and harrow would be moved by steam as well as carriage and wagon'.[3]

Science

These theorists had very long term horizons on the technological prospects of the economy, yet few made the connection between the economy and the special impact of scientific advance. In fact, it was only Say who showed very much interest in the area. Others such as McCulloch and Ellis

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1. J. B. Say, Des Principes de l'Economie Politique et de l'Impôt, par M. David Ricardo, Avec Notes Par M. Jean Baptiste Say, (Two Vols.), Paris, 1819, i, 269; ii, 3
2. R. Torrens, An Essay on the Production of Wealth, p.90
3. R. Torrens, On Wages and Combinations, London, 1834, p.43

were only keen on patent regulations to ensure that sufficient time and energy be devoted to the discovery of new techniques.[1] Say had a very enlightened view of the diverse connections between science and technology. Say perceived the direct impact of the utility of many sciences which, until recently, had only been seen as 'objects of curiosity and speculation'. What most impressed him, however, was the powerful indirect influence of science. Science dispelled prejudice. It taught man to rely on his own exertions rather than on supernatural powers. 'Ignorance' was the 'inseparable concomitant of practical habits' and of 'that slavery of custom'.[2] If workmen understood the nature of the things they worked with, they would be more productive. Science could, furthermore, 'increase social happiness' by acting as an antidote to alienation.[3]

This is not to say, however, that Say regarded science as the key to industrial advance. Scientific knowledge was indispensable, but it was not a major bottleneck. Men of science were interested in the diffusion of their ideas, so that scientific knowledge circulated rapidly and the nation without scientists need be at no disadvantage. Say identified the crucial bottlenecks as the 'application of knowledge' and the 'skill of execution'. These attributes were extremely difficult to transmit to others.[4]

Say, however, also offered some penetrating proposals for government expenditure on the promotion of science. Science could only be applied to practical purposes if it was discovered and preserved by the theorist. Thus the government should find some means of paying theoretical scientists.[5]

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1. William Ellis, 'Employment of Machinery', p.126
2. J. B. Say, A Treatise, i, p.49
3. ibid., ii, pp.311 - 314
4. ibid., and i, p.53
5. J. B. Say, A Treatise, i, pp.57 - 58

'A government that knows and practises its duties and has large resources at its disposal should not abandon to individuals the whole glory and merit of invention'. Government support for scientific research was not to be deducted from national capital, but from national revenue. If the burden was paid by all, then all would benefit.[1] Further, government support by honours and rewards to 'artists' and mechanics was also to be encouraged. 'They excite emulation and enlarge the general stock of knowledge without diverting industry and capital from its most profitable channels.'[2] Another form of encouragement, patents, acted as a premium from the government chargeable on the consumers of the new article. They were harmless, since they offered no interference with other branches of industry.[3]

The great enthusiasm for the extension of science, capital and machinery felt by many of the economists of the time even found its way into political thought. The growth of capital was the fulfilment of the public interest.[4]

The rise of the middle classes derived from the expansion of fixed capital. As W. A. McKinnon put it, the middle class was created on the basis of the social mobility brought about by the extension of machinery.

> 'in all establishments where machinery is used, a great expansion takes place amongst the leading men of every branch of the department, amongst the engine makers, etc., men who by their industry, knowledge and attention to business have attained such situations; or by others who, from their probity, good conduct and fair dealing, have the loan of some capital, which enables them in time, to create some for themselves. All these descriptions of persons originating in the lower class, rise by

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1. J. B. Say, A Treatise, i, p.58
2. ibid., p.252
3. ibid., pp.268 - 270
4. [Anon.], Inquiry into those Principles Respecting the Nature of Demand and the Necessity of Consumption lately Advocated by Mr. Malthus, London, 1821, p.28. This pamphlet was sent to Ricardo by Tooke. Ricardo to Malthus, 21 July, 1821, ed. Sraffa, Works, ix, pp.26 - 27

degrees into the middle.'[1]

Machines, Gluts and Labour

The great interest in the processes of scientific and technical change, and generally, the great enthusiasm for it was not, however, a blind optimism. The outcome of all the great advances in technology over the period extending back to the late Eighteenth Century was still too uncertain to predict. There was an atmosphere of ambivalence in writing as a whole in the period, and even some attempt to look critically at costs and benefits of the industrializing process. The age of mid-Victorian self satisfaction was yet to come. The major areas calling for some estimate of gains and losses were the fears of overproduction, and the confrontation between machinery and labour. In the first, old underconsumptionist disputes were refuelled by the prospect of machinery leading to general overproduction. Malthus' fears rested on his assumption that a leisured unproductive class was necessary to soak up the surplus. Neither capitalists nor workers had anything but very limited consumption patterns.[2] Owen and Sismondi, who also believed that the widespread use of machinery would lead to overproduction explained this, on the contrary, by the unequal distribution of income. The working classes had a very high demand elasticity, and a shift in the distribution of income from rich to poor would open an infinitely extendable market.[3]

As for the second area of ambivalence, I have already written at length on some policy disputes and Ricardo's remarkable intervention in the issue

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1. W. A. McKinnon, M.P., On the Rise, Progress, and Present State of Public Opinion in Great Britain, London, 1823, p.161
2. T. R. Malthus, Principles, pp.120 - 123 and pp.312 - 313
3. Robert Owen, A New View of Society and Report to the County of Lanark, p.210; and J. C. L. S. de Sismondi, Nouveaux Principes, i, pp.120 - 123, 327 and 352 - 353. Note that Ricardo too had pointed out that there was no reason why labourers should not take over the consumption of conveniences and luxuries. Notes on Malthus, ed. Sraffa, ii, pp.312 - 313

on machinery and labour. Real practical concerns and an analytical puzzle made this an issue that was taken up by nearly every theorist in the 1820's, and was made an issue of discussion in the Political Economy Club.[1] The disputes continued, indeed right through the 1830's, though they tended to focus less on Luddism than on the plight of the handloom weavers and the agricultural labourers.

The ideas developed by John Barton and Ricardo on the relationship between fixed capital investment and the demand for labour provoked severe reaction. Both, unlike the underconsumptionists, started from the assumption of fully employed factor markets. Barton was the first to distinguish fixed and circulating capitals according to their impact on the labour market. In his Observations, 1820, he took issue with the view that every increase of capital set in motion an additional quantity of labour.

> 'The demand for labour depends, then, on the increase of circulating and not of fixed capital. Were it true that the proportion between these two sorts of capital is the same at all times and in all countries, then indeed it follows that the number of labourers employed is in proportion to the wealth of the state. But such a position has not the semblance of probability. As arts are cultivated and civilization extended, fixed capital bears a larger and larger proportion to circulating capital ... It is easy to conceive that under certain circumstances the whole of the annual produce of an industrious people might be added to fixed capital, in which case they would have no effect in raising the demand for labour'.[2]

Barton argued that there was a long run tendency to rising capital intensity. As capital became more plentiful it was invested in the construction of machinery, in making roads, digging canals, and other improvements which brought about some saving in labour. Barton tempered

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1. This question was raised by Ricardo at the second meeting of the Club, but was not discussed until 4 February, 1822. See Minutes of the Political Economy Club, Centenary Volume, vi, 7
2. John Barton, Observations, p.16

the force of his conclusions, however, by pointing out that as long as capital accumulation, development, and technical change continued to take place, there need never be great fears over the demand for labour. The actual process of fixed capital formation was a great employer of labour.[1]

Ricardo's reformed views on machinery and labour, incorporated into his third edition were, as I have shown, a development of Barton's possible case. Given a fixed supply of capital, labour was transferred from the production of necessaries, or consumer goods to the production of machinery. This decline in the funds for the employment of labour would lead to a decline in the demand for labour over the economy as a whole.[2] There would be an increase in net revenue or surplus, and a decline in gross revenue on total final product while the machinery was under construction. Demand for labour would always be dependent on the expansion of gross revenue.

The reaction provoked by this analysis was not only the immediate one I have described in Chapter Two, but a long term interest in the issue. Torrens and Ellis both made more serious attempts to come to terms with the chapter, mainly by investigating alternative sources of investment. Torrens, for instance, argued that the capitalist would have no motive for constructing a machine unless it led to a higher rate of profit. But as profits increased, capital would accumulate more rapidly, and this more rapid accumulation of capital would restore the original demand for labour.[3] He also saw fit to include an entire chapter refuting Ricardo's views in his popular work Wages and Combinations in 1834. Ellis went yet a step further to argue that the original investment for the machine making sector

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1. John Barton, 'Effects of Rising Wealth on Luxury and Prices', Manuscript Notebooks, written between 1814 and 1817, p.159
2. Ricardo made it quite clear in his speech on Cobbett's pamphlet that he was referring to a decline in the demand for labour, not in any one sector, but over the economy as a whole. 'Wages of Manufactures', Hansard, ix, 602
3. Robert Torrens, An Essay on the Production of Wealth, p.xi

need not be taken from a 'wage fund' but could be drawn from increased savings induced by the expectation of higher profits after the machinery was built, and the process would be self perpetuating.

> 'When that additional capital is introduced, motives in abundance are presented for a still further accumulation, since profits will have risen in as much as the same number of labourers, aided by more powerful instruments, will be able to produce a larger quantity of commodities.'[1]

The impact of higher savings and profits rates was a very important counteracting factor, but even more so was the relative time period in which new machinery would be introduced. Simon Gray was the one who pointed out that the major periods for the introduction of new machinery were advancing ones, when both prices and wages were high. The wages of both the makers and users of the new machinery had historically been higher than those of former employees. Furthermore, the construction of machinery was a new and thriving branch of industry which could only be regarded as an important spin-off of mechanization.[2] Arguments along the lines of these criticisms of Ricardo's chapter were echoed frequently through the pamphlet literature of the period in what were often long turgid justifications of the introduction of machinery.[3]

Even Malthus held no real objections to the extension of machinery per se. His real worry was the extension of demand in proportion to the increase in productivity. He was, however, never very impressed with Owen's proposals for spade husbandry. His reasons for this can be found in his dispute with John Barton.[4] Malthus at first disagreed with Barton's view that the demand for labour was tied to the increase of circulating not

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1. William Ellis, 'Employment of Machinery', Westminster Review, 1826, p.116
2. Simon Gray, The Happiness of States, p.106
3. See for example, William Pettman, An Essay on Political Economy, Part II, pp.40 - 61
4. T. R. Malthus, Principles, p.237

fixed capital. This disagreement rested on Malthus' belief that any increase in fixed capital was generally favourable to circulating capital. If the advance in fixed capital was gradual, it would lead to increased productivity and cultivation of waste land. A higher proportion of population would be released to manufacturing, the value of general production would rise, and with it the demand for labour.[1] The natural tendency of machinery was to cheapen a commodity and thus to extend the market. In practice, however, there was often a substantial loss involved in transferring capital from one employment to another.

> 'The power of the whole capital to command the same quantity of labour would depend on the contingency of vacant capitals being withdrawn undiminished from old occupations and finding equivalent employment in others.'[2]

Malthus' obsession with the market led him into great enthusiasms for the reciprocal action of the extension of foreign markets and the invention of machinery. This reaction to the doubts of Ricardo and Barton became the characteristic one. Theorists admitted the conceptual possibility of technological unemployment, but mitigated the force of Ricardo's case by seeking counteracting factors. The pessimism of Barton and Ricardo on the question of the impact of machinery on the working classes was thus successfully relegated to the realm of analytical puzzles. The theorists who followed Ricardo were uncertain enough of economic prospects to comment extensively on the Ricardo case or the problem in general. However, the end of their investigation was to submerge these doubts by drawing practical and policy attention to the overpowering counteracting factor of the growth potential in the total British economy.

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1. T. R. Malthus, Principles, p.239
2. ibid., p.350

Stationary States

Finally, after a wide ranging and remarkably intensive discussion of the prospects of British industry, economists seem to have concluded on a fairly acquiescent plane. Even if population or capital should grow more quickly than was desirable, or even if capital was scarce or wages high, there was always a self generating form of technical progress which could ultimately overcome all these problems. But there is still the shadow in this period of those concepts of the declining rate of profit and the imminence of the stationary state. Did economists in this period give any serious thought to these apparently ambiguous concepts of Ricardian economics?

Many historians of thought have given rather excessive concern to the role of the stationary state in classical thought. They have accepted the classicals too easily as prophets of doom, and have seldom stopped to question the status of the falling rate of profit and the stationary state. They have too often confused the conceptual systems and attitudes to reality among the classical economists.[1]

I have shown the attitudes of Ricardo and his contemporaries could hardly be called ones of despair. And certainly the condition of the first industrial workers had little to do with their ideas on the prospects of British growth. If anything, it was the economist above all others who was either optimistic or blind, and possibly both to the conditions of the working classes in northern towns or southern villages during the period. It is certainly true that Ricardo's analytical system was set up to explain the tendency towards a declining rate of profit, and it is also true that he spoke of a future stationary state. But the practical eventuality of

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1. See for example Michel Lutfalla, L'Etat Stationnaire, Paris, 1964, p.153 Lutfalla argues that it is paradoxical that in the period of the Industrial Revolution there should be this tradition of despair in economic theory.

either of these phenomena was almost inconceivable. It is important to remember that Ricardo's system was also built up to recommend ways of avoiding the falling rate of profit. Even Malthus regarded the falling rate of profit as extremely remote. He argued that the decline in the rate of profit that came from the progressive cultivation of poorer land would be extremely slow or more than balanced by continual agricultural improvement, including improved implements and machinery as well as better systems of cropping and managing.[1] McCulloch, in the 1820's, still believed in the final eventuality of the stationary state. But again such a possibility was very remote. He argued that the productive energies of the earth were constantly rising due to discoveries and inventions.

> 'improvements in the skill and industry of the labourer and in machinery may counterbalance the disadvantages of an inferior soil and an unfavourable climate'.[2]

But still from the operation of 'fixed and permanent causes', the 'rise in the sterility of the soil must in the long run overmatch the increasing powers of machinery.'[3] McCulloch, however, eventually gave up diminishing returns and the stationary state altogether.[4]

This optimism was continued by both James and J. S. Mill who conceived of an ideal stationary state. The fame of J. S. Mill's stationary state has often obscured that of James Mill. Winch, however, has pointed out that Mill introduced a series of social arguments for why capital accumulated more slowly than population increased. Men reached a certain plateau of wealth where they had no further motivation to accumulate, but many inducements to enjoy their leisure.[5] John Stuart Mill did not give up the final stationary state, though he left it a benevolent one. As Neil de Marchi

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1. Malthus, Principles, p.271
2. J. R. McCulloch 'Say, Sismondi, Malthus', p.117
3. J. R. McCulloch, Principles, p.383
4. See D. P. O'Brien, J. R. McCulloch, p.298
5. See James Mill, ed. Donald Winch, p.195

puts it:

> 'Mill's belief in the "habitual antagonism" of the "progress of civilization" did not in any way undermine his opinion that diminishing returns tended to outweigh cost reducing improvements as such.'[1]

The political economists of the 1820's attached little practical significance to the imminence of the stationary state. The power of technical progress had gripped the imagination of most. The economists who followed Ricardo criticized the conclusions of his model, but found in it a source of inspiration. The model provoked many into investigating ways of avoiding falling rates of profit and stationary states. One key way was for them to reveal the gains from technical change. The economists and their substantially middle class public showed great zeal in observing and promoting the mechanisms of technological transformation in the industrializing British economy. Their observations did, moreover, reveal a certain pattern - a pattern defined by the idea of the division of labour. This, as I have noted before, was the focal point of a certain stage of development, one defined by Marx as the 'phase of manufactures'. The continuity of this pattern of ideas from the time of Smith into the 1820's definitely undergoes a change of emphasis in the 1830's. Political economists moved on to describe, or at least to predict, a structural shift in the economy to one based on fixed capital. Using Marx's terms once again, this change could be described as belonging to the new period of 'modern industry' in contrast to the period of 'manufactures' which still underlay the 1820's.

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1. N. de Marchi, 'John Stuart Mill and the Development of English Economic Thought', (ANU.Ph.D.Thesis, 1970), p.160

CHAPTER FOUR

The 1830's: The Political Economy of Modern Industry

The reformulation of 'technology' in terms of capital and machinery can be said to mark off the political economy of the 1830's as the political economy of modern industry. Historians have not drawn attention to this structural connection, but they have pointed out other features which give this political economy a separate dimension.

There is a striking consensus of opinion among historians that the Ricardian phase of classical economics was in decline in the 1830's. The 1830's has been identified as the period of reaction against Ricardo, but rather little has been said of the alternative vision of these critics. The sharpness of this break is somewhat illusory. Diverse and critical inquiry was just as much a characteristic of the previous decade as it was of this one. Many of the critics of the 1830's seemed to be developing dissatisfactions expressed by earlier sceptics of Ricardo. It is true that mention is often made of a meeting of the Political Economy Club on 13 January, 1831, to discuss the progress which had been made since Ricardo, and the extent to which Ricardian economics had been undermined. Little reference is generally made, however, to the final outcome of that meeting. Mallet reports that

> 'McCulloch stood up vigorously for Value as well as Rent and paid very high compliments to Ricardo, whom he still considered as right in most points, and at all events as having done the greatest service to the science, his methodical and scientific way of treating it, so that even where he was mistaken, his errors could be detected by a subsequent and more correct analysis.'

The Political Economy Club, in fact finally agreed that Ricardo's Principles were 'in the main, right.'[1]

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1. Mallet's Diaries, 13 January, 1831, Political Economy Club, Centenary Volume, p.223

Many have also identified these years with a sense of disorientation, a sense of a void due to lack of authority. Indeed, contemporaries were particularly sensitive about the lack of consensus in their discipline. Samuel Read was one of the many who expressed this feeling.

> 'By all who are acquainted with the most recent and most noted works on Political Economy, it will be readily admitted that the science is at present in a very unsettled and unsatisfactory state. There is indeed scarcely a single doctrine - if we except that of commercial freedom, as expressed long since by the French economists - upon which there is perfect and uniform, or even general agreement, among the numerous sects and schools into which the science is now divided.'[1]

This fear of diversity of opinion, however, was also endemic to the 1820's. McCulloch had objected to Ricardo's change of heart on machinery for the dangerous effect it would have on the credibility of political economy.

> 'nothing can be more injurious to these interests than to see an Economist of the highest reputation strenuously defending one set of opinions one day and unconditionally surrendering them the next ...'[2]

The lack of authority seems to have been just as problematical in the 1850's when Torrens commented that the 'current controversy' was a transitional phase, and that economists must come to trust in the authorities of the discipline.[3] However, the concern over the lack of authority in the earlier years of a self recognized political economy revealed deeper underlying changes. The critique of Ricardo gathered momentum from the late 1820's. Earlier dissent was, as I have shown, very extensive, but the depth and force of the critique of the 1830's penetrated political economy at all levels. The search for broader foundations for political

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1. Samuel Read, An Inquiry into the Natural Grounds of Right to Vendible Property or Wealth, Edinburgh, 1829, p.v
2. J. R. McCulloch to D. Ricardo, 5 June, 1821, Works, viii, ed. Sraffa, pp.382 and 385
3. Cited in A. W. Coats, 'The Role of Authority in the Development of British Economists', Journal of Law and Economics, vii, 19 4

economy went forward not only among theorists, but in economic policy and in the culture of the middle class citizen.

Political Economists

The theorists under consideration in this chapter will be these: Mill, McCulloch and Torrens; Senior, Whately, Lloyd, and Longfield; Scrope and Read; the 'colonizers'; and Hamilton and Rae. Many of the economists of the 1830's considered themselves to be in some measure, critics of Ricardian doctrines. I will say more later of their actual positions, and classify them now simply in their contemporary identification as political economists.

A number of these critics have been accredited by historians of economic thought with significant innovations in economic analysis. It will help in assessing the historiographical significance of these critics if I point out briefly what these analytical advances were. The theorists of the 1830's are generally viewed by historians of thought as the precursors of marginal utility theory. They brought with them a shift in the idea of value from one which defined value as a socio-economic relation between commodities in the market to one which defined it as a psychological assessment of utility. Meek argues that this served as a basis for a new theory of distribution where the distinction between income from work and income from property became irrelevant.[1] Honour is given to Lloyd for his discovery of the theory of diminishing marginal utility.[2] Schumpeter, however, is less impressed with these pioneering efforts at a theory of marginal utility. Those who espoused the theory mostly used a primitive supply and demand analysis, and they failed to exert any perceptible

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1. Ronald Meek, 'Economics and Ideology', Economics and Ideology and Other Essays, ed. R. Meek, London, 1967, p.208
2. Marian Bowley, Studies in the History of Economic Theory before 1870, London, 1973, pp.154 - 156

influence.[1] Schumpeter was, however, taken with Senior's discovery of a productivity theory, that is an approach that saw a product as a means of further production.[2] And Bowley has admired Longfield's discounted productivity of labour theory of wages.

> 'In Longfield's system all the prices given by non-economic parameters had disappeared; all prices were flexible and explained in terms of economic influences and thus all quantities were related to prices. The aggregates had disappeared from the theory of distribution and hence the need to try to determine labour's share in terms of the wage fund'.[3]

One of the most commonly remembered innovations of this group of theorists was the idea that abstinence was a factor of production and profit a compensation for sacrifice. With this went the corollary that interest was a measure of risk and of discounted future returns. Abstinence was defined as a willingness to sacrifice the present for the future - the psychic cost of saving. The net yield of capital goods was in the nature of a payment for services rendering saving. The theory had, what Schumpeter called, a commonsense appeal that recommended it to a long line of authorities thereafter.[4]

Another striking feature of the 1830's is that political economists made even more explicit the social purpose of their writing. Fears over class conflict were expressed more often and more overtly by the high theorists of political economy. The significance of this fear of conflict has been developed by Meek and Dobb. Meek established some connection between the appearance of socialist doctrine and the emergence of new apologetic theories. Dobb expands on this and on

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1. J. Schumpeter, History of Economic Analysis, London, 1954, pp.599 - 601
2. ibid., p.638
3. Marian Bowley, Studies in the History of Economic Theory, p.217
4. J. Schumpeter, History of Economic Analysis, p.660

Blaug's earlier point that the writers who criticized the Ricardian socialists were also the first to develop the abstinence theory of profit.

> 'In this sense, the theoretical innovations of the "neglected British economists" were not unrelated to the nature of the class struggle after 1830 ... And if we choose to regard the labour cost theory of value as the kernel of Ricardian economics we are driven to assert that the vital influence of Ricardo came to an end in the 1830's.'[1]

The most recent expression of this view is Marian Bowley's reassessment of Senior. Bowley now admits that Senior's view of profit as a reward for the sacrifice of abstinence helped to justify profit and to dispose of suggestions of exploitation. His stress on capital as a growth factor was due to anxiety over political attacks on profit and fears that the supply of capital might dry up. The declining influence of Ricardo's model led to an analytical void and a political interpretation of the Wealth of Nations and Ricardo's Principles. For this reason, Senior and Longfield felt a need to fill this analytical void.[2] This case for a social context has been seriously disputed only by Neil de Marchi. He argues that the Ricardian socialists had little influence. But the evidence he cites for this is not convincing, particularly since he neglects to mention Hodgskin the only Ricardian socialist mentioned by most of the critics of Ricardo in this period.[3]

It would, however, be too simplistic to identify political economy in these years with purely political or apologetic objectives. For this was simultaneously a period when economists became more preoccupied with the

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1. Cited in M. Dobb, Theories of Value and Distribution since Adam Smith, Cambridge, 1973, p.98
2. Marian Bowley, Studies in the History of Economic Theory, pp.211 - 215
3. Neil de Marchi, 'John Stuart Mill', pp.115 - 116. The evidence he does use is that Gray dissociated from the Owenites early in the 1830's, that Thompson died in 1833, and that Bray left England for America in 1842. Yet all of the critics discussed here were writing before 1842 and most prior to 1833.

scientific attributes of their theory. The economists of these years held strong, but various political positions. The attempt of the philosophic radicals to claim Ricardian political economy as an integral part of their politics broke down very early. Now a utilitarian radical such as T. P. Thompson could simultaneously conduct his political campaigns using the rhetoric of classical economic doctrine, and mount a theoretical critique of Ricardo's theory of rent. Senior's whiggism did not prevent him from engaging in a critical extension of Ricardo's ideas. Both Scrope, a paternalist Tory M.P. and Archbishop Whately, combined substantial political activism with progressive economic theory.[1]

What one finds, however, is that political economists seem to have been in the very complicated position of both attempting to place their theory in a neutral and scientific realm, and of feeling the necessity of intervening in existing and imminent social conflict. Economists could be politicians, but it was not from their politics, but from a neutral scientific economics, that they wished to show the lack of foundation for conflict. In some sense, the fear of politics and political bias was overdone. This is aptly illustrated by Mallet's amusement with the circumstances of Richard Jones' appointment to the chair in Kings College. The officials of the college had asked Senior to resign after he published a pamphlet recommending reform of the Irish Church, and they wanted to change the title of the chair from political economy to political philosophy,

> 'but Jones said that if the latter title were adopted he should feel himself free to treat of Political Institutions - perhaps the ballot - which so alarmed the Conservatives that they gave way.'[2]

But the feeling of urgency for a scientific political economy which

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1. Scrope, in fact, was known in political circles as 'Pamphlet - Scrope', a reference to his vast turnout of political pieces.
2. Mallet's Diaries, Political Economy Club, vi, 1 May, 1834, p.262

could pronounce on social conflict was even greater. Mallet was dismayed at the lack of interest in Jones' lectures

> 'Political Economy is a subject of universal discussion. The newspapers and the reviews teem with articles - good, bad, and indifferent - on this subject ... and yet not a single student ... thinks it worth while to attend to the opinions of an able and sensible man on the principles which might enable him to judge between right and wrong in that science. No wonder that so much dangerous absurdity makes its way into books and conversations in the practice of life.'[1]

Swing Riots and Socialists

This dual concern of economists to erect a scientific economics, and yet to intervene politically in order to ward off social conflict pervades the writing of these years. A fear of conflict and more especially of socialism had a measure of influence on most of the economists surveyed here. Among the actual events which provoked a definite focus on conflict was the Swing riots.[2] Mallet found the Political Economy Club meeting of the 3rd December, 1830, abuzz with news of the disturbance.

> 'We were rather too full of politics, the destruction of machinery, and so forth: the general opinion seems to be that if these disorders lasted there must be either an increase of military force or some sort of National Guard.'[3]

The situation led to a special debating session on the 13th January, 1831 on the subject of the causes of discontent and distress in the agricultural districts. The members seem to have agreed that there was no particularly pressing distress among the agricultural labourers, and that the disturbances had 'originated in political excitation'.

> 'the concurrence I have mentioned as to the great exaggerations which prevail and are industriously disseminated on the subject of agricultural distress,

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1. Mallet's Diaries, Political Economy Club, vi, 12 April, 1833, p.249
2. For a comprehensive history of the agricultural riots in these years and their outcome see E. J. Hobsbawn and G. Rudé, Captain Swing, London, 1969.
3. Mallet's Diaries, 3 December, 1830, Political Economy Club, vi, p.218

> is the more remarkable as there are all shades of political opinion among the Members of the Club, several of whom are radical reformers.'[1]

Senior opened his Three Lectures on Wages in 1831 by explaining that they were written in a period of tranquillity, but the country was now

> 'in a state which may require the exertions of every individual among the educated classes, and many may have to assist in executing, or even in originating measures for the relief of the labouring population, who are not yet sufficiently familiar with the principles according to which that relief is to be afforded.'[2]

The agricultural riots too were the motivation for his long discussion, in these lectures, on machinery and labour. His major fears were that 'The consequences of the present system' had not been explained to labourers, hence the declaration of his right to good wages. The greatest danger came from those who 'assumed the fund out of which the labourer is fed was unlimited .

> 'Have not even magistrates and landlords recommended the destruction, or, what is the same, both in principle and effect, the disuse of every machine of which the object is to render labour more efficient in the production of the articles consumed by the labourer in the production of that very fund on the extent of which, compared with the number to be maintained, the amount of wages depends? ... Threshing machines are the present objects of hostility, ploughs will be the next.'[3]

A reviewer of the second edition of McCulloch's Principles saw utility in political economy at a time 'when the south of England is spread with the smoking ruins of farm houses and the ashes of cornstacks and barns.' He, too, claimed a lack of 'politico-economical knowledge' as the major culprit.

> 'The outrages which the enemies of political economy deplore in common with its friends, arise in the greatest part, and immediately, from the vulgar errors concerning

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1. Mallet's Diaries, 13 January, 1831, Political Economy Club, p.222
2. Nassau Senior, Three Lectures on the Rate of Wages, London, 1830, p.iii
3. ibid., p.xiii. For a discussion of the actual extent of feeling among farmers and magistrates against the threshing machine, see E. J. Hobsbawn, and George Rudé, Captain Swing, chap. ii

> machinery and wages, which a knowledge of the natural laws that regulate the production and distributions of the wealth of nations can alone dissipate.'[1]

Another Edinburgh reviewer returned to the issue two years later to point out the educative role of recent works of popular political economy in aiding the introduction of agricultural machinery.[2] Neither did the readers of the Westminster Review escape the topical lessons of political economy. T. P. Thompson reviewed 'The Life and History of Swing the Kent Rick-burner, 1830' to warn readers of the outcome of an ignorance of political economy.[3]

If rioting in the countryside provoked such a reaction, there was probably equal concern over the issue of trades unions and mechanization. Senior, along with Thomas Thomlinson, in 1832 drew up a 'Report on Combinations'. The Report showed great concern with the interference of unions with technical progress, and even included interviews with anonymous textile manufacturers. These interviews, conducted with an elaborate questionnaire, helped Senior to 'prove' that certain combinations had indeed interfered with the introduction of new techniques.[4] The message was also clear in E. C. Tuffnell's Objects and Effects of Trades Unions of 1834.

This very specific context of immediate class struggle is to be distinguished from another bogey of the political economists. They also voiced strong objections to the socialist vision. James Mill wrote to Brougham in 1832 of the idea of the rights of the labourer to the whole

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1. [E. Coulson], 'McCulloch's Principles of Political Economy', lii, Edinburgh Review, 1831, 337 - 338
2. [William Empson], 'Mrs. Marcet, Miss Martineau', Edinburgh Review, lvii, January, 1833, 17 and 18
3. [T. P. Thompson], 'Machine Breaking', Westminster Review, xiv, Jan., 1831, 191 - 210
4. Report on Combinations by N. W. Senior and Thomas Thomlinson. Presented to Rt. Hon. Lord Viscount Melbourne, Secretary of State, 21 August, 1832. Senior Papers, National Library of Wales, Aberystwyth

produce of his labour. He described this as 'the mad nonsense of our friend Hodgkin (sic) which he has published as a system ... These opinions, if they were to spread, would be the subversion of civilized society.'[1] Longfield warned that opinions were no longer inactive. The question was no longer whether the working class would generate opinion, but how 'a true sense of their own interests' was to be made clear to them. Political economy was a 'defensive science' which attempts to 'prevent the injudicious interference of speculative legislation'.[2] Scrope drew attention to a general feeling throughout society that the 'physical and mental happiness of man' were socially determined. Thus 'social arrangements' could be infinitely improved. For Scrope, however, political economy was not defensive. Welfare was the primary object of policy.[3] Finally, Senior saw himself grappling in his Outline of Political Economy with a new race of visionaries. One of his reviewers in setting out Senior's dilemma described the situation of many of the theorists of the 1830's.

> 'There is at work a wide-spread dissatisfaction with the present state of society; and a disposition to trace all evils which afflict it to the competition of capitalists and labourers amongst themselves, and their supposed competition with each other. It is as if the philosophical world, never long contented with a simple adherence to the same system, had tried the laissez faire theories of Smith and Turgot to the uttermost, and thrown them aside in mere weariness, and through a desire for new excitements.'[4]

The work of individual socialist economists was usually mentioned with respect to the discussion of attacks on profit and capital. Apart from James Mill's allusion, Hodgskin was sketched by a writer in the Quarterly

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1. Cited in Anton Menger, The Right to the Whole Produce of Labour, London, 1899, 'Introduction by H. S. Foxwell', p.lxxvi
2. Mountifort Longfield, Lectures on Political Economy, Dublin, 1834, pp. 6 - 10, 17 - 18
3. G. Poulett Scrope, Principles of Political Economy, Deduced from the Natural Laws of Social Welfare, London, 1833, pp.viii - ix
4. /Herman Merivale/, 'Definitions and Systems of Political Economy', Edinburgh Review, lxvi, Oct., 1837, 80

Review, as an influence more 'pernicious' than the Owenites.[1] Scrope objected to the Owenites and the Saint-Simonians:

> 'Its designers forget that the industry of which in the present advanced state of society they witness the fruits, has been brought into being, and has hitherto grown and thriven, only under the shelter of the institution of private property and the stimulus of competition.'[2]

But again it was Hodgskin who came under his wrath when capital was the subject of discussion. Hodgskin was identified with declamations 'against capital as the poison of society, and the taking of interest on capital by its owners, as an abuse, an injustice, a robbery of the class of labourers'.[3] Hodgskin was not mentioned by Longfield, but he, too, identified as the source of socialist doctrine men who were 'conscious of their invalidity', whose object was 'to create disturbance, by stimulating the passions of the poor and ignorant, and persuading them that their poverty is caused by oppression'.[4] Much of this polemic was situated within discussions of the role of capital and the determination of the rate of profits. It is quite obvious that much of this new theory was defensive and an apologetic.

But these same economists were simultaneously seeking an escape from the political connotations of political economy. They addressed themselves to those who dismissed political economy because it was 'political'. One answer was that of Richard Whately who preferred to describe political economy as 'catallactics', the science of exchanges. He used his credentials as a theologian in the Drummond chair to fight the prejudice against political economy 'among those who represent it as unfavourable to religion'.[5] Scrope

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1. Anon., 'Rights of Industry and the Banking System', Quarterly Review, March, 1832, 411 - 412
2. G. P. Scrope, Principles of Political Economy, p.63
3. ibid., p.150
4. M. Longfield, Lectures on Political Economy, p.158
5. Richard Whately, Introductory Lectures on Political Economy, London, 1831, p.vi

argued that this attitude to political economy was prevalent only because of the mistakes of the economists themselves. Political economy had been discredited by the 'dogmatism of the hyper economists'. He blamed empiricism and practical men for the most pernicious errors. He also disclaimed the tendency to see political economy as a physical science and was not enthusiastic over any fashionable 'political mathematics'.[1] This rhetoric directed at ignorance was increasingly asserted as a need for neutrality. It became a debate on methodology in order to obscure more fundamental political differences. The political overtones of Senior's introductory lecture on political economy were given a methodological sophistication five years later in his Lectures on Wages. In 1826 Senior had complained of the 'many crude and mischievous theories about, which are dignified with the name political economy', and he feared that the subject would be 'left by the advocates of religion and social order to those hostile to both'.[2] In 1831 he argued

> 'Hitherto, it has been common to defend every existing practice as agreeable to common sense, in opposition to the visionary schemes of political theorists ... To what has common prejudice, reigning under the title of common sense, brought us? Have the practical men who have hitherto administered our system of poor laws, saved us from being brought to the very brink of ruin?'[3]

Political economy in the 1830's curiously combined an ideological evangelism on behalf of capital with internal debate on the method and scientific status of economics. An understanding of this latter debate is basic to any perspective taken of the contributions of these political economists to the theory of economic development.

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1. G. P. Scrope, Principles of Political Economy, pp.36 and 41
2. Quoted by [Anon.], 'Senior's Lectures on Population', Edinburgh Review, 1828, pp.170 - 173
3. N. Senior, Three Lectures on the Rate of Wages, p.xx

The Method of Political Economy

The methodological positions of theorists were various, but most overt discussion reflected two unifying concerns: a concerted attack on practical men and a return from the Ricardian model to the scope of Smithian economics. The debate over abstraction and induction was a matter of some concern, but except for extreme exponents, most took an eclectic stand on the issue. Perhaps the most extreme views were held by Senior and those who followed him in the Drummond chair, Whately and Lloyd, and by Longfield, the first professor in the chair created in Dublin in 1833 by Richard Whately.[1] These theorists had some notion of their own cohesiveness as indicated by Whately's suggestion for the formation of a Political Economy Society, to be set up by Senior, Tooke and a few others.[2]

All of the above theorists forged close connections between theory and policy with the distinct object of routing the authority of the practical man and common sense. As Senior put it,

> 'By practical men are meant, ... those who have had experience in the matters which political economy considers. But who has not had that experience?'[3]

He quoted Whately's assessment that common sense should only be appealed to where there was nothing else to trust to. Economic theory, as agreed by

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1. Whately and Senior had long been good friends. Senior had provided an appendix 'Ambiguous Terms in Political Economy' to Whately's Logic, London, 1826. Senior, too, after the conclusion of his first years in the Drummond chair, took great pains to have Whately appointed the next professor. Whately to Senior, 13 June, 1830, Senior Papers. Longfield, however, was not previously known to Whately, but was chosen as 'the one whose answers I had pronounced the most favourably.' Whately to Senior, Nov., 1832, Senior Papers. Little is known of W. F. Lloyd, who gave 36 lectures at Oxford, of which only 12 were published. His brother, Charles, however, was Bishop of Oxford in the 1820's. See Richard Romano, 'Research Notes on the Search for W. F. Lloyd's Papers', History of Economic Thought Newsletter, No.14, Spring, 1975, pp.13 - 15
2. R. Whately to Senior, 11 August, 1831, Senior Papers.
3. Nassau Senior, An Introductory Lecture on Political Economy, London, 1827, p.24

these theorists, should be based on a few general propositions derived from observation, and the conclusions of this theory were to be directly applicable to practice.[1]

Senior's attitudes mellowed, however, and the substance of his ideas in the Outlines of Political Economy, 1836 ran parallel to those of John Stuart Mill who first published his essay 'On the Definition of Political Economy', in the same year.[2] Senior, in 1836, separated pure and applied economics. He no longer considered good theory as consistent with good policy. The science of political economy had been confused with the act of policy, and this confusion was responsible for 'exciting in the public unfavourable prejudices'.[3] Some years later Senior clarified his position on abstraction in a letter to Quetelet, the Belgian statistician.

> 'for though I do not consider the truths of political economy as founded on statistical facts, yet its illustrations generally are.'[4]

Mill, too, limited the scope of economic theory. It was an inquiry which did not encompass the whole of man's nature as modified by the social state, but rather treated man solely as a being who desired to possess wealth and was capable of judging the comparative efficacy of means to that end. Mill had gone far from his early doctrinal days, and now set himself above both mere empiricists and dogmatic theorists.

> 'it has been again and again demonstrated, that those who are accused of despising facts and disregarding experience build and profess to build wholly upon facts and experience; while those who disavow theory cannot make one step without

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1. See Nassau Senior, Introductory Lecture on Political Economy, pp.35 - 36. Also see M. Longfield, Lectures on Political Economy, p.3. W. F. Lloyd, Two Lectures on the Justice of Poor Laws and one Lecture on Rent, London, 1837, p.81
2. J. S. Mill reports that he wrote his essay in 1830 and revised it in 1833, Autobiography, p.180
3. Nassau Senior, An Outline of the Science of Political Economy, London, 1836, p.3
4. Senior to Quetelet, 1843, Senior Papers.

theorizing.'[1]

He developed a sophisticated combination of induction and ratiocination. Theorists argued upwards from a broad range of particular facts to a general conclusion, then proceeded downwards from general principle to a variety of specific conclusions. Mill certainly did not deny the practical nature of economics. Theory was a guide to action. There could be no prediction without an adequate explanation of existing circumstances. The theorist must always be alert to the disturbing influence of unforeseen causes and unexpected results.[2]

In this essay, Mill in fact articulated the guiding principles of Ricardo's method of presenting political economy. The first of these was that abstraction was the only practical method of solving complex problems. From this, followed the necessity of distinguishing between regular and disturbing causes, and of viewing the propositions of political economy as tendency statements. Finally, Mill asserted the major scientific requirement of theory - that all economic theories be subject to an empirical test.[3]

McCulloch and several contemporaries, such as Scrope, Torrens, and John Rae moved even further towards an inductivist and professedly Smithian approach. McCulloch and Scrope both devoted themselves to singling out the practical nature of economics, without, however, giving way to the practical men.[4]

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1. J. S. Mill, 'On the Definition of Political Economy; and on the Method of Philosophical Investigation in that Science', Westminster Review, xxvi, October 1836, p.15
2. ibid., 20 and 21
3. See N. B. De Marchi, 'The Empirical Content and Longevity of Ricardian Economics', Economica, (n.s.) 63, Aug., 1970, 266
4. See J. R. McCulloch, Principles of Political Economy, Preface to the third edition, Edinburgh, 1843. McCulloch points out that these were the same views he expressed in his second edition of 1830. Also see G. P. Scrope, Principles, pp.xi - xii and [G. P. Scrope], 'Jones, on the Doctrine of Rents', Quarterly Review, xlvi, Nov., 1831, 81 - 83

Statistical work would provide the basis for a broadly inductive process of reasoning. McCulloch paid great heed to statistics, and Scrope was heavily influenced by Richard Jones' defence of inductive reasoning, of which I will say more below.[1]

Torrens and John Rae both asserted the Smithian nature of the inductivist frame of mind. Torrens and his new peer group, the colonizers[2] justified their new interest in colonization by the authority of Smithian market theory, and induction was part of their platform.

> 'There is a school of political economists who assume, that capital possesses some occult quality, or influence by which it creates for itself the field on which it is employed, and renders demand co-extensive with supply ... With the economists who take the 'high priori' road and anticipate the results of science by assuming the facts from which their principles are deduced, I presume not to contend. But to those who regard political economy as an inductive science, the principles of which are nothing more than general facts established by experience, I confidently submit the following considerations, as showing that capital cannot create for itself the field of profitable employment.'[3]

John Rae, relatively isolated after emigrating to Canada, did at least influence Senior, who incorporated Rae's ideas on saving in his Lectures of 1847. He too espoused an inductive approach and did write an essay on Smith's use of inductivism and the real foundations of Baconian method.[4]

The prospects of a return to the scope of Smithian economics, and of achieving a compromise between inductive and deductive positions stimulated a historical and comparative approach to theory. This, in turn, affected

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1. [G. P. Scrope], 'Jones, on the Doctrine of Rents', Quarterly Review, xlvi, Nov., 1831, 81 - 83
2. The major analytical work on colonies was done by Wakefield, Torrens, and Merivale. Merivale was Drummond Professor from 1837 to 1839. These theorists envisaged the possibility of a glut, and saw colonies as a solution. Colonies offered a 'field of employment' for labour and capital, and thus a way of warding off a decline in the rate of profit. See Donald Winch, Classical Political Economy and Colonies, London, 1965, pp.83 - 89
3. Cited in Lionel Robbins, Robert Torrens, p.179
4. John Rae, Statement of Some New Principles of Political Economy, Boston, 1834.

the questions which were asked. The political economy of this period shows less concern with analyzing the static structure of an economic system than with defining the origins and development of that system.

This new economics was, in effect, a theory of development, with the growth of fixed capital at its axis. The theory was expressed through the analysis of these elements: population growth, the origin of capital, profits and abstinence. The analysis of these factors prompted a reformulation of the roles of the division of labour and invention, and of machinery and the accumulation of capital.

Population

The critics diverged most markedly with the Ricardians over the law of population. This criticism became so strong in the 1830's that it became a new orthodoxy. Even McCulloch, despite his defence of Ricardo, came to deny the principle of population. By the 1830's he was criticizing Chalmers for stressing Malthusian doctrine.[1]

It was incumbent on the critics to prove that the population growth that led ultimately to a decline in the rate of profits was either not inevitable or could be overcome. These profits led to the increase of capital, and with it, the expansion of fixed capital which brought improvement. Senior first developed his criticisms of the Malthusian population principles in his Lectures on Population of 1828. Here he argued that increasing returns to labour were due not to the production of more from the same physical source, but to economies of large scale production. Skill increased in some relation to population and capital. These criticisms became definitive in his Outlines to such an extent that Merivale, his reviewer could not resist commenting,

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1. [J. R. McCulloch], 'Dr. Chalmers on Political Economy', Edinburgh Review, lvi, October 1832, 54

> 'The doctrine of population is, in Political Economy, what that of original sin is in theology, - offensive to philosophical pride, and irksome to sanguine temperments.'

People prefer to be told that

> 'there are extrinsic causes at work, which promise to render the ancient law of our nature a mere philosophical curiosity - a theorem without application, - that machinery and science, and facilities of communication, are outstripping ... numbers.'[1]

Scrope reviewed Senior's Lectures in 1831 and argued with Senior that the impact of population growth could be and in fact was overcome by the 'rising productive powers of agriculture, and the arts auxiliary to it'. But he explained the process of population growth as something itself historically specific. Using the findings of Robert Hamilton's Progress of Society, he argued that agriculture was itself an invention belonging to a certain era in the history of the human race. The discovery of agriculture and the constant advance in agricultural techniques up to the present had precisely allowed for an increase in population.[2] Scrope's delight with Richard Jones' Essay on Rent was only marred by his suspicion that Jones was influenced by Malthus' theory of population. Here he pointed out the possibilities discovered by the colonizers. The employment of capital for emigration and the opening of new avenues for the profitable

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1. cf. [H. Merivale], 'Definitions and Systems of Political Economy', Edinburgh Review, October, 1837, p.95
   See N. W. Senior, Two Lectures on Population, London, 1829.
   Neil de Marchi argues that Senior's criticism of Ricardo's use of the law of population was unjustified. He argues that Senior did see the distinction between historical generalization and statements about what may be expected in the absence of any countervailing cause. Senior, according to de Marchi, chose to disregard principles. For him, the advance from a barbaric to a civilized state was conclusive proof that subsistence increased more rapidly than numbers. All this is true, but the empirical form of Ricardo criticism was dominant in these years. Senior's critique was evidently popular for he was given support by Tooke, McCulloch and Torrens, in a discussion of the issue at the Political Economy Club in 1835.
   See N. de Marchi, 'John Stuart Mill', p.119
2. [G. P. Scrope], 'The Political Economists', The Quarterly Review, xliv, Jan. 1831, 49.

employment of capital in the colonies would lead to the accumulation of new capital.[1] Finally, when Scrope came to write his own Principles one of his primary objects was to 'refute the gloomy predictions of the Malthusians'. Scrope condemned Chalmers at great length for ascribing to 'a most portentous and abominable doctrine'. He described Chalmers as obsessed with the rate of population growth and the limits to agriculture. As such he was 'Bound within the necromantic circle which Malthus has forbidden him to dream of overstepping'.[2]

Some critics in these years, like some previous thinkers, regarded population growth as positively beneficial. Their analysis, however, was a more forceful one, derived from a combination of the new theory of self generating improvement. Longfield was one to make this point. Population growth in the civilized country was beneficial because it was combined with a more general 'skill, intelligence and integrity'. Such a country would produce rather than import those goods which required skill and integrity of the workman and intelligence and capital of the capitalist.[3]

The Source of Capital

Since capital was the commanding feature of an idea of economic improvement that was regarded as more dynamic than population growth, it is natural that the critics should apply themselves to the origins of capital. McCulloch saw that the key to the expansion of fixed capital and to an ever greater division of labour was not the size of capital stock, but the productivity of new investment. Senior, however, went further back and explained the origin of capital directly by abstinence. He made abstinence a factor of production in the same sense as labour.

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1. /G. P. Scrope/, 'Jones on the Doctrine of Rent', pp.112 - 114
2. /G. P. Scrope/, 'Dr. Chalmers on Political Economy', Quarterly Review, xlviii, Oct., 1832, 69 and 51
3. M. Longfield, Lectures on Political Economy, pp.240 - 241

> 'by the word Abstinence, we wish to express that agent, distinct from labour and the agency of nature, the concurrence of which is necessary to the existence of Capital and which stands in the same relation to Profits as Labour does to Wages' [1]

It was Read, however, who gave the greatest attention to the question. His objective was to show that the share of the capitalist, that is, profits and interest, were not a deduction from the wages of labour. Rather, both labour and capital contributed to production. The co-operation of capital was usually necessary both to high wages and the creation of a surplus. At its origin, capital was a product of land and labour. But it immediately united with these to produce its own future profit. As soon as capital accumulated into a 'mass' it became a 'separate and independent instrument', and an 'original source of wealth'. Like Senior, Read believed that ultimately capital owed its existence to 'human providence, foresight and parsimony', or what Senior called abstinence.[2]

If capital was described as the result of abstinence, it was not unusual, in addition, to regard capital as the result of skill and the 'labour' of a particular class. Senior discovered this in his very early essay on definitions. He complained that the usual definitions of capital excluded knowledge and skill. Wages and profits were a human creation, and both resulted from a sacrifice of ease or present enjoyment. Thus he included in his definition of profits the 'wages' of the 'labour' of the capitalist.[3] Senior later clarified the distinction between fixed capital and his general conception of capital. He identified the use of capital with abstinence. There were, however, two necessary corollaries to abstinence - the use of 'implements' and the division of labour. Implements

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1. N. Senior, An Outline of Political Economy, p.59
2. Samuel Read, An Inquiry, pp.30, 48 - 51, and 63 - 67
3. N. Senior, 'Ambiguous Terms in Political Economy', Appendix to Richard Whately, Elements of Logic, second edition, London, 1827, p.320

were categorized into those that produced power such as machines worked by wind, water, or steam, and those that transmitted power such as hand impelled tools. Implements could not be brought into use without some exercise in abstinence. Carrying his theory of abstinence to the extreme, he argued furthermore, that it was a fiction for economists to speak of landlord, capitalist and labourer as sharing in production. All that was produced was, in the first instance, the property of the capitalist. It was the capitalist who paid rent and wages prior to the production process; it was the capitalist who abstained to make production possible.[1]

Senior's hypothetical history of the origin, and development of capital was indicatively static. He failed to consider the possibility of one production process growing out of another, or that the relations between social groups or classes involved in the production process might have differed over time.

His hypothetical history, however, suited his purposes, as was admirably borne out by the conclusions of those critics who used a similar historical model. Longfield made a similar case for the application of capital 'in the support of labour' as the prior condition of the introduction of machinery. This was the basis of wage payments. The capitalist paid the labourer as much as he could earn without the aid of machinery. Any productivity differentials after the introduction of this fixed capital were defined as the property of the capitalist.[2]

Neither Senior nor Longfield found it convenient to say anything of the differences in the character or structure of a production process after the introduction of the fixed capital that they so hypothetically outlined. W. F. Lloyd, however, was more explicit:

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1. N. Senior, An Outline of Political Economy, p.69
2. M. Longfield, Lectures on Political Economy, p.190

> Employers, the owners of much fixed capital, have a strong and direct interest in over-working their labourers, and the smallness of their number, joined to the superiority of their intelligence and other circumstances, gives to them a power which throws the workmen entirely at their feet.'1

The payment of wages and the form in which those wages were paid very much mirrored these attitudes. Hobsbawn has evidence to show that employers in the Nineteenth Century acquired their skilled labour at less than market price because the workers' wage calculation was for a long time determined by a customary pre-industrial wage hierarchy.[2] The form of wages also became a major preoccupation. Economists in the 1830's turned from an interest in wage levels to the systematic treatment of the form of wage payments. They gave greater favour to piece rates. They recognized this as a method of uniting the interests of the worker to the output of machinery, a combination encouraging greater efficiency.[3]

The description and classification of general capital or even simply fixed capital was not something attempted by this set of theorists. As long as they lacked this, they could assume only some benign role for that fixed capital which they defended so vigorously. John Rae, however, found a way of classifying and ordering capital that offered a quantitative measure of its role. He defined capital as based on instruments. These included all durable capital and other physical transformations designed to affect future events. Each instrument had a particular 'capacity' to produce desired events, and this was measured by a standardized daily wage. The cost of production of instruments was measured by labour inputs. Each instrument was also subject to 'exhaustion', the process by which instruments

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1. W. F. Lloyd, Two Lectures on the Justice of the Poor Laws and One Lecture on Rent, p.105
2. E. J. Hobsbawn, 'Customs, Wages, and Workload in Nineteenth Century Industry', Labouring Men, ed. E. J. Hobsbawn, New York, 1967, p.409
3. L. Bernhard, Die Akkordarbeit in Deutschland, Leipzig, 1903, cited E. J. Hobsbawn, 'Custom, Wages and Workload', p.420

were again transformed into materials or dissipated. Food and fuel, for example, were exhausted quickly, and machinery slowly. Instruments were ordered according to their cost of production, their capacity, and the length of time for their exhaustion. The greater the capacity and the lower the cost of its production, the closer would an instrument be to the fastest returning capital. Rae's classification also allowed for some measure of the impact of technical progress on the means of production. The capacity of an instrument could be raised by adding either to its durability or to its efficiency without a change in techniques or what Rae called 'progress in the arts'. However, 'neither of these could be indefinitely increased without carrying instruments to orders of slower and slower return'. Hence the extent to which orders of such instruments either did not change or became ones of faster return was a measure of the impact of technical change.[1]

Whither Profits?

The origin of capital was only debated as a background to the more topical issue of profits and abstinence. Senior's allusion to the 'wages' of the capitalist, since skill was one of the 'causes' of capital, was not extraordinary among a set of critics who spoke of 'productive services' and the 'wages of superintendence.'[2] Mill elaborated this in his essay on 'Profits and Interest'. The dealer who invested outside his trade gained the difference between the rate of interest and the rate of profit. This difference formed the wages of superintendence. Alternatively, if the capitalist borrowed capital from elsewhere and invested it in his own trade, he also gained wages of superintendence on this. Mill, however, contrary

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1. John Rae, New Principles of Political Economy, pp.109 - 117
2. G. Koolman, 'Say and the Entrepreneur' argues that it was not until this period in Britain that some recognition was given to the role of entrepreneurship. He argues that G. P. Scrope, Samuel Read, and George Ramsay took the concept from Say.

to his contemporaries, argued that the wages of superintendence were not regulated by the same principles as other wages, but by a commission on the capital employed.[1] The wage of superintendence was usually used to imply that the psychic cost of saving for the entrepreneurial capitalist was similar to the physical cost of labour. It was in this sense that Read found McCulloch's concept of profit inadequate. McCulloch in his view, had only gone part way and defined profit as 'that product due to the employment of capital and remaining to the owner of capital after deductions for production costs and depreciation'. The crucial question which McCulloch did not take up, in Read's eyes, was 'How much should be allowed as the wages of "the owner of capital" superintending the industrious undertaking.'[2] John Rae was yet another who argued that the profit of stock must be a return for the mental exertion and anxiety of the owner of stock.[3]

George Ramsay, unlike most of these critics, took pains to distinguish the supervisor or master of an enterprise from the capitalist. He argued that the master did not do manual labour, and that his profits could not be said to be proportional to his 'mental qualities' as these could not be quantified. Profits were simply a proportion of employed capital.[4] The master, again, was distinct from the capitalist or rentier.

> 'On the one hand there are masters, on the other, labourers, capitalists, and landlords, combined. The interests of these two grand classes are diametrically opposed to each other. It is the master who <u>hires</u> labour, capital and land, and of course tries to get the use of them on as low terms as possible; while the owners of these sources of wealth do their best to <u>let</u> them as high as they can.'5

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1. J. S. Mill, 'Of the Influence of Production on Consumption', and 'On Profits, and Interest', <u>Essays on Some Unsettled Questions</u>, ed. J. S. Mill, London, 1844, pp.59 and 107
2. Samuel Read, <u>An Inquiry</u>, p.247
3. John Rae, <u>New Principles</u>, p.195
4. George Ramsay, <u>An Essay on the Distribution of Wealth</u>, Edinburgh, 1836, pp.209 - 211
5. ibid., p.219

Economists found more reason for profits in the compensation for acts of making advances and for risk. Longfield explained that the value of labour fixed in or transferred to any article was greater than the wages of that labour. The excess was the profit of the capitalist, a compensation for his advances of his capital. It was argued, however, that the capitalist was an intermediary who led to greater efficiency. The profits demanded by the employer were always less than the increase of wages which the labourer would demand if he had to await payment until the sale of the commodities. The manufacturer could afford to accept less as compensation for what he advanced.[1] Scrope included risk as a factor of compensation. Returns had to be sufficient to 'recompense trouble and skill', replace fixed and circulating capital, and cover the risks of obsolescence.

> 'The risks of these kinds attached to manufacturing operations are ... much greater than in agriculture; and hence the compensation or insurance against such risks must be proportionately large.'[2]

Scrope cryptically slipped in the assertion that the level of compensation was not physically but socially determined. Returns were to be sufficient to pay the ordinary rate of profit on total capital

> 'as well as remunerate him for his skill and trouble, according to the standard of remuneration generally expected by his class.'[3]

Just as the critics were able to find many reasons why the share of profits should be high, so they found other reasons for the tendency of the rate of profits to rise rather than fall. J. S. Mill investigated the conflicting tendencies in the rate of profit. On the one hand the rate of profit tended to fall because either capital rose faster than population,

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1. M. Longfield, Lectures on Political Economy, pp.170 - 171
2. G. P. Scrope, Principles, p.209. Scrope's source for this was Babbage who claimed machinery seldom wore out before it became technically obsolescent. He calculated that any piece should have paid for itself in five years. p.210
3. G. P. Scrope, Principles, p.211

which increased competition for labour and put pressure on the wage rate; or population increased faster than capital and brought demands for more food which had to be produced at greater cost. Generally the rate of profit would not fall unless one of two events took place: a rise in the workers' standard of living or rising costs in producing or importing the workers' subsistence. The rate of profit had a tendency to rise if population growth was greater than the increase of capital and brought greater competition for employment without at the same time raising subsistence costs. Alternatively, improvements could lower the cost of necessaries.[1]

Senior and Longfield were also interested in the tendency of the rate of profit, but placed greater emphasis than Mill on those factors checking the fall in the rate of profits. Mill grudgingly admitted the effect of improvements in agriculture, but remained fairly dismissive of their long term impact. Senior argued if more labour was employed in the construction of durable machinery, both the rate and the amount of profit rose without any fall in wages. The machine was a 'new labourer, but one that costs nothing to maintain'. Senior seems, oddly, here to have forgotten the 'wages of superintendence' and the compensation for abstinence.[2]

Longfield's limits on the declining rate of profit were these: a rising population which gave greater scope to the employment of capital; improvements which opened new avenues for investment and new ways for superseding labour; greater skill and 'good conduct' on the part of labour; and finally greater 'intelligence, attention and industry' among capitalists.[3] Unlike the Ricardians and Mill himself, Longfield also allowed for advantages in a low rate of profit. Primarily, a falling rate of profit lowered the discount

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1. J. S. Mill, 'Profits and Interests', Essays on Some Unsettled Questions, p.106
2. N. Senior, An Outline of Political Economy, p.194
3. M. Longfield, Lectures, p.229

rate on investment. This would favour the accumulation of capital by encouraging greater investment in heavy fixed capital and social overheads. A major disadvantage of this process was a smaller income for the capitalists, and consequent difficulties in the accumulation of capital.[1] George Ramsay summed up the general attitudes of the critics when he praised the extent of recent progress.

> 'The products of manufacturing and commercial industry as steadily increase in quantity as they improve in quality. The rise in the raw material, which they derive from agriculture, retards them, no doubt, a little in their course, but the vast discoveries in machinery, and the prodigious facilities for intercourse afforded by numerous canals and rail-roads far far outstrip this obstacle to their progress, and leave us lost in amazement as well at their present state as at the prospect of their future advancement. Now these improvements must greatly tend not only to increase the mass of commodities, and diminish their price, but also to raise the rate of profit.'[2]

The colonizers as already mentioned, explored the check that colonies exercised on the falling rate of profit. It was no other than Mill who came to admit that there was something to the argument. He rejected Wakefield's view of the general glut, but in 1836 did agree that the rate of profit in England was so low that 'the capital of the industrious classes overflows into foreign countries and into all kinds of wild speculations'. By 1843 Mill was advocating the transfer of redundant labour and capital to outlying possessions to raise raw produce to trade with the manufactured goods of the parent country.[3]

The pivotal concern with the role of fixed capital and profit also refined the old controversies on value. Little, however, was added to previous formulation of alternatives to the labour theory of value. Theorists generally wavered between a utility theory and cost of production

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1. M. Longfield, Lectures, pp.229 - 230
2. George Ramsay, An Essay on Distribution, pp.189 - 190
3. See N. de Marchi, 'John Stuart Mill', pp.73 - 76

approaches.[1]

Paths to Progress

Problems both of quantifying the impact of technical change, and of identifying the sources of increasing returns provided a major incentive for investigating the dynamics of development. Theorists sought to understand the origins of existing techniques and to define more precisely the total impact of a particular evolving set of techniques. They were critical of Ricardo's model because it abstracted from the explanation of techniques. They returned instead to the Smithian framework of the division of labour as the basis for more realistic theorizing.

They were newly interested in researching the dynamics of invention, and what they produced was a political economy which included a number of sociological explanations rather than an abstract model of growth. The great interest of the theorists of this period in innovation in all its many dimensions cannot be separated from their methodology. Many, as I have pointed out, were open to the inductive methods of the period. Others recognized the imperative of theory and the construction of models, but were also aware of the insufficiency of explanations which did not account for the role of psychological and social relations. Historians have missed a whole range of theories on how economies progress and change. This has been the cost of a fascination either with analytical advances or with apologetics. De Marchi's statement of the impact of theories of organic evolution after mid-century is only indicative of a failure to recognize

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1. See M. Bowley, Studies, pp.148 - 156. G. P. Scrope, Principles, pp.164 - 166 and 188 - 189 and N. W. Senior defended a utility theory, though they gave ultimate value determination to the cost of production. Samuel Read, in Natural Grounds to the Rights of Vendible Property, stuck to a pure capital theory of value. C. F. Cotterill and M. Longfield continued to use a labour theory of value. See Cotterill, An Examination of the Doctrines of Value, London, 1831, p.54; and M. Longfield, Lectures, p.110

the interests of those writing two decades before.[1]

One illustration of the interests of economists of this period in the division of labour is a discussion which took place in the Political Economy Club in 1839. Chadwick asked about Smith's passage from the Wealth of Nations which concluded that the division of labour contributed to the sacrifice of intellectual, social and military virtue among the poor. Chadwick, Jones, Lloyd and Merivale all doubted that the degree of division of labour in their industrial society had gone or could go this far.[2] The views of the colonizers were certainly of no minimal importance here. Their discussion of 'fields for the employment of capital' was combined with a political economy of new countries. The imperative of efficient production in new countries was stressed over and over again. The colonizers unlike Smith, had no qualms about the division of labour - it was the engine of progress in the old world and so it must be in the new. Malthus, Scrope and Torrens all argued that unless productivity in agricultural countries kept pace with that of British industry, the net barter terms of trade would turn against Great Britain. Colonizing was, therefore, a method of influencing the rate of development in the colonies.[3] Obviously, the critics were not the first who had looked at the colonies. For both Smith and the Ricardians these new countries settled by Europeans were the most rapidly advancing of any human society. This rapid progress was the result of the combination of European skills with abundant supplies of fertile land. But Wakefield saw this abundance of land as a curse. It led to dispersion of the labour force, little concentration of production, and technically inefficient methods. The creation of markets, the division

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1. N. de Marchi, 'John Stuart Mill', p.15
2. 'J. L. Prevost's Diaries', 2 Dec., 1839, Political Economy Club, vi, p.280
3. See Bernard Semmel, The Rise of Free Trade Imperialism, Cambridge, 1970, pp.186 - 193

of labour and capital accumulation were all included under his principle of the 'complex combination of labour'. This principle was a natural property of labour in old countries, but not in the colonies.

> 'Without co-operation and the division of employment, capital and labour are so weak and so unproductive that surplus produce either for foreign exchange or for accumulation at home, cannot be raised. This is a primitive or barbarous state of things.'[1]

Wakefield argued that early settlements had only become prosperous because of slavery, and he referred to the state of the labourers under his system of complex combination as one of 'natural slavery'. I will say more of the meaning of this in my final section.[2]

One of those who had similar views to Wakefield on the interaction between concentration and the division of labour was McCulloch. McCulloch, as noted, had long despised the domestic system because it hindered the division of labour. McCulloch placed capital as pre-requisite to the division of labour. 'Accumulation and the division of labour act and react on each other', leading to the invention of machinery. Most of McCulloch's work, and particularly his Edinburgh Review articles placed great emphasis on the limitless prospect of invention. His view that techniques were advanced by concentration and the division of labour, explains his prejudice in favour of growth biased to the manufacturing sector. But McCulloch was critical enough not to be too overawed by the factory. He was unimpressed with Ure's conception of the factory system. This system could only account for the spinning and weaving branches of the textile industry. Worse, it

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1. Wakefield, Report of the Select Committee on South Australia, Appendix, quoted in Lionel Robbins, Robert Torrens and Classical Economics, pp.158 - 159
2. A detailed discussion of Wakefield's system can be found in Lionel Robbins, Robert Torrens, and Donald Winch, The Classical Economists and Colonies, pp.90 - 98

had nothing to do with the vital machine making industry.[1] The division of labour and the development of new techniques were speeded along by colonization. McCulloch, in addition, welcomed the reception of foreign artisans, and urged the spread of education which 'multiplied the means and chances of improvement and prevented any invention or discovery from being engrossed by the few'.

> 'an uninstructed people, though surrounded by all the means and capacities for the production and accumulation of wealth, being unable to apply them to any useful purpose, are necessarily poor and destitute'.[2]

The critics of this period did not discuss the division of labour as central to the labour process, but rather as an attribute of capital ... Not only was capital pre-requisite to the division of labour, but by an easy leap, the possession of tools and thus the creation of private property were also assumed to be prior conditions. Senior described the 'rude state' of society as one where everyone owns all the implements. However, when expensive machinery and a great variety of tools had superseded the few simple instruments, 'those only who can profitably employ themselves in any branch of manufacture ...' are those 'who can acquire machinery or are trained to work it.'

> 'Every great mechanical invention is followed by an increased division of labour and every greater division of labour produces new invention in mechanism.'[3]

The division of labour, too, generated a transfer from unproductive to productive labour.

> 'The division of labour has banished from our halls to our manufactures the distaff and the loom: and if the language to which we have been adverting were correct, the division of labour must be said to have turned

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1. See D. P. O'Brien, J. R. McCulloch, A Study in Classical Economics, pp.275 - 280 and /J. R. McCulloch/, 'Philosophy of Manufactures', Edinburgh Review, lxi, July, 1835, 454
2. J. R. McCulloch, A Statistical Account of the British Empire, ii, London, 1837, p.37
3. Nassau Senior, Outlines, p.74

> spinner and weavers from unproductive into productive labourers and from producers of immaterial services into producers of material objects.'1

Whately and Longfield affirmed that private property was necessary to the division of labour. Equality of property, Whately pronounced, confined men's possessions to the barest necessities. Necessity led only to simple inventions. It was only when men were released from necessity that they were led to desire luxuries. And it was Whately's opinion that few discoveries were conducted with a view simply to utility.[2] Longfield had a much more worked out justification of the property foundation. After the institution of property, 'the idea was conceived of a man working at one part of a number of goods then at another for an employer who pays wages'. The different operations completed by separate individuals would be impossible where each workman was working for himself. Under the wage system, the employer assigned work according to aptitude and prevented the loss of time of transferring jobs. This division of labour under the control of the capitalist brought greater skill through practice on one art, and new discoveries and innovations.

Longfield did not, however, agree with Whately about the relation between the market and innovation. It might be that discoveries were not made with utility in mind, but the greatest innovations by the introduction of machinery and the use of a more extended division of labour had been made in those industries producing standardized goods intended for the poor.[3]

Scrope made a political point of the necessity of the principle of private property. Objecting to the Owenites, he quoted various historical examples to show that those societies which had existed under communal

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1. Nassau Senior, Outlines, p.53
2. Richard Whately, Introductory Lectures, p.144
3. M. Longfield, Lectures, p.105

property arrangements had been 'rarely ... observed to make any advance in the arts of production or the accumulation of wealth'.[1] On the advantages of the division of labour, Scrope, greatly influenced by Babbage, stressed the economy of time and power 'due to a well regulated division of labour' and he drew attention to McCulloch's extension of the concept of the division of labour to include the division of labour of the mind, as for instance, when chemistry became separated from natural philosophy. Scrope was also one of the few to mention the property of the labourer. Generally, the only property of the labourer was a little acquired skill. The land, tools and machinery indispensable to labour and the food that formed the labourer's subsistence were all appropriated by other classes. This placed the people 'in a precarious position', and it was in an area like this that the paternalist Scrope saw a need for government intervention to give protection to the working class.[2]

The division of labour generated skill, a vital aspect of technical change. Both Senior and Scrope devoted considerable thought to the development of skills, their diffusion, and impact. Senior had great difficulty in settling on an adequate categorization of skill in relation to labour and capital. In his Lectures of 1826, he defined accumulation as consumption for the purpose of reproduction. He argued that skill was capable of such accumulation, so that he referred to the 'perpetual transmission of knowledge and skill.'[3] In the Outlines of 1836, he spoke of 'mental capital', or knowledge and education, and regarded this as the most adaptable form of capital. However, even skill, like other forms of capital, was subject to a degree of processing through the action of the division of

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1. G. P. Scrope, Principles, p.61
2. ibid., pp.299 - 308
3. Senior Papers, N. Senior, 'Lectures', i, No.6 'On the Various Scientific Definitions of Wealth', p.318

labour. It, too, ultimately became less pliable or less easy to transfer between industries and branches of production.

> 'The skill which the division of labour gives to each class of artificers prevents the peculiar dexterity an individual may have from being of any value in a business to which he has not been brought up.'[1]

Skill was defined in the early Lectures and in the Outlines as a form of capital. Such 'acquired abilities' were 'fixed and realized in the person of the possessor.' 'The greater part of the remuneration for skilled labour is the reward for the abstinence implied by a considerable expenditure on the labourer's education.'[2]

Just to highlight this, I will point out that by the time of his later lectures in 1848 - 49, Senior had come around to a quite different classification of skill. He now argued that the attempt to identify skill with capital would result in a reduction of the factors of production to the single one of capital, and that wages and rent would collapse into profits. Man was an intelligent instrument of production who should be conceptually distinguished from 'the brute and inanimate agents', generally identified with capital.[3] There were thus two genera of instruments of production: the 'mental and bodily faculties of man', and capital.[4] Curiously, he had now also changed his ideas on the perfect mobility of knowledge and skill. In these lectures, he now maintained that one reason why knowledge and skill were not forms of capital was that they could not be completely transferred from one being to another. Skills were learned, not appropriated.[5]

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1. N. Senior, Outlines, p.217
2. ibid., p.69
3. Nat. Lib. Wales, Aberystwyth, (Senior Papers), N. Senior, 'Lectures', Course II, Lecture III, 1848, p.50
4. Senior Papers, N. Senior, 'Lectures', Course II, Lecture II, 'Classification of Instruments of Production', p.37
5. ibid., p.37

Scrope continued with this investigation into the process of diffusion of skills. Skills were often taught by actual exhibition and repeated experiment. When a skill was handed down from master to pupil through successive stages, it accumulated the improvements of its various users on the way. Many of the most progressive innovations had also been developed from 'useful knowledge', that 'accumulated ability stored in books' [1] Another theorist named Robertson looked at the communication of innovations and the division of labour from the perspective of economies of scale. As fixed capital was extended, so was the necessity of a cheap source of fuel. It was in those districts where coal was cheap that the most extensive factory complexes were established. The industry that was horizontally integrated, that is where its separate branches were dispersed to separate establishments carried the division of labour to its utmost. As each branch increased in scale, greater and more diverse skills were required and developed.[2]

Some of the most interesting discourses on innovation covered the social and psychological motivation behind discovery. Most of the critics banally asserted that inequality created a necessary 'emulation'. It was only Robertson and Hamilton, however, who used the concept to develop an alternative social model. In contrast to the classical class divisions, they postulated a smooth and harmonious gradation of ranks. The major motivation behind industry was the wish to preserve rank in society. The gradual advance of the few produced a feeling of emulation.[3] 'Indolence' was the product either of a 'want of neighbourhood' where no extensive

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1. /G. P. Scrope/, 'The Political Economists', p.13 and Principles of Political Economy, Chapter v. Babbage was the direct source for Scrope's examples if not for many of his ideas in this section.
2. /George Robertson/, Essays on Political Economy in which are Illustrated the Principal Causes of the Present National Distress, London, 1830, pp.71 - 74
3. ibid., pp.35 - 36

gradation could be established, and of the supply of luxuries.

> 'If the acquisition within his reach be lower, he may give way to indolence. Every improvement in art and skill which renders labour more productive, adds to the quantity of labour performed by offering a higher reward for it.'[1]

But the reason for inequality was not only to create envy, or a form of deprivation effect, it was also to provide the necessary 'share of leisure' for the 'cultivation of genius'.[2] It was this fascination with the inventor and his precise social role which prompted W. A. Mackinnon to take up the issue of patents. He brought in a bill in 1837 to amend the patent laws so as to preserve to Britain 'that pre-eminence' and 'to use every endeavour to promote the welfare of ingenious men, by securing to them the benefits of their inventions.'[3]

Aside from some description of the generation and diffusion of new techniques, few of the economists actually took up the relationship between inventions and innovations. John Rae appears to be the only one who went into the question in any detail. He classified techniques into two types. Those which changed the basic materials of production, and those which extended the same materials to different industries. These changes in techniques had diminished the propensity of mankind to servile imitation, by bringing to light 'the general principles of things'.[4] Inventions which could be adapted and used across several industries were, however, far more important than those which simply changed materials in one branch. The diffusion of a particular invention across several industries established general principles. Simultaneously the situation where industry was both concentrated and diverse was the most compatible with the creation of general

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1. Robert Hamilton, The Progress of Society, London, 1830, p.32
2. ibid., p.179
3. Speech of W. A. Mackinnon, M.P., on Letters Patent for Inventions, London, 1838, p.1
4. John Rae, New Principles, p.225

principles. Rae illustrated his explanation with the example of the diffusion of steam technology. The diffusion of the piston reduced the concept of power to a familiar form for many processes of production. On this basis, the development of steam power was then assisted by the scientific discovery of the doctrine of latent heat.[1]

Man and Machine

Crucial to the central role of fixed capital in the theory of the 1830's was the analysis of machinery and the accumulation of capital. The occasion of this analysis was the machinery and labour question. Senior felt it necessary to carry out a complete critique of Ricardo's chapter on machinery. Longfield and Scrope also confronted the issue. Senior concluded that the doctrine that the rate of wages could be reduced by the introduction of machinery was valid in only two cases: that where labour generally employed in the consumer goods sector was transferred to the capital goods sector, and that where the capital goods sector consumed commodities otherwise consumed by labourers. The only possible setback was, therefore, in the costs of constructing machinery. After this, its use enhanced the wage fund. Senior, however, saw this setback as only logically possible. In reality, he argued, the expense of machine building was paid out of profits and rent.[2] Longfield also dismissed Ricardo's case. In all practical cases, a machine was never resorted to unless it led to lower costs of production, and this independent of the proportions of wages and profits. At any rate, even if it appeared that the introduction of machinery reduced the rate of wages, this could be explained by the cost of production which included the expenses of building and repairing any machinery used. This was translated into 'labour expended at a greater

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1. John Rae, New Principles, pp.172 and 183
2. N. Senior, Three Lectures on the Rate of Wages, pp.39 - 62

length of time'. The time factor made it necessary that a greater proportion of price consist of profits.[1] Only Scrope, because of his paternalist concern for the poor, recognized a problem of mobility behind any change to new techniques. A change in the mode of production in particular industries did lead to the unemployment of those who had worked on an older method. Labour was not perfectly mobile between techniques or branches of industry. 'The prejudice against machinery, still prevalent among the poor and ignorant' was understandable, and ways had to be found of increasing the mobility of labour.[2]

The idea of technology in the 1830's was somewhere in between the focus on the division of labour in earlier periods and the fascination with self regulating power in a later period. Senior showed interest during the 1830's in the attributes of inanimate power, but directed his attention mainly to the 'improvement' entailed by power machinery. He was fascinated by Marsland's Stockport factory which he reports seeing in 1825. He enthused

> 'if the power of directing inanimate substances, at the same time to exert the most tremendous energy, and to perform the most delicate operations, be the test, that dominion and power are nowhere so strikingly shown as in a large cotton manufactory.'3

Senior went into some detail describing the water power system and the connection of all the shafts in Marsland's factory. He conceived of power in the same terms in which he thought of machinery.

> 'In the operation of machinery, power, like matter, seems susceptible of indefinite aggregation and of indefinite subdivision. In the performance of some of its duties the machinery moved at a rate almost formidable, in others at one scarcely perceptible.'4

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1. M. Longfield, Lectures, p.219
2. G. P. Scrope, Principles, p.192
3. N. Senior, Outlines, p.70
4. ibid., p.71

One of Senior's major sources in this discussion was the Report of the Committee on Artisans and Machinery of 1824, which I will discuss in greater detail in a later chapter. The Report gave Senior ample evidence of one essential quality of machinery - its 'susceptibility of indefinite improvement'. And it was to cotton machinery combined with the steam engine that he attributed the major economic transformation he was living through.

> 'Sixty years form a short period in the history of a nation; yet what changes in the state of England and the Southern parts of Scotland have the steam engine and the cotton machinery effected within the last sixty years. They have almost doubled the population, more than doubled the wages of labour, and nearly trebled the rent of land.'[1]

Contrasted with this world view, where fixed capital was a material substance with the technical attributes that it replaced labour, and was more durable and efficient, was a perception expressed, for example by Senior in his 1847 lectures. Here he gauged that the real triumph was inanimate power, particularly that which began with steam. What distinguished it from all other forms of power was its 'manageableness' and regularity.

> 'The engine does all that requires force. The workman has only to supply it with materials and to perform the services which being irregular and unforeseen cannot be obtained from an irrational agent.'[2]

The regularity of this force allowed for greater precision in verifying the quantity and quality of goods so produced.[3]

What Senior now saw as the essential qualities of modern machinery were force, dexterity, uniformity, and safety.[4] Gone was the interest in giving material description to fixed capital as machinery. Gone was the interest in describing the production process as a structure where labour

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1. N. Senior, Outlines, p.72
2. Senior Papers, N. Senior, 'Lectures', Course II, Lecture 7, 1848, pp.23 - 24
3. ibid., p.33
4. ibid., p.42

co-operated with fixed capital, albeit dominated by the 'more superior' capital. Now attributes of both machinery and labour were derived from the domination of moving power. This conception of the new industrial dimension offered by the use of power also prompted Senior to look into the sophisticated combination of the types of force generated by hand tools and those based on moving power. Not just steam power, but tools, had been integral to England's industrial transformation. 'Few things in England are so striking to a foreigner as in the abundance and variety of our tools.'[1] Such tools, combined with power, produced ever new innovations, such as the adaptation of the simple hammer to the steam hammer. Moreover, steam according to Senior, created the conditions for the introduction of electricity. The railway provided the long level lines along which wire could be conveniently extended.[2]

This remarkable vision gave the outlines to Marx's later formulation of a phase within economic development which he termed 'modern industry'. This was a phase distinguished by Marx for the role of the machine and the automatic system of machinery. Machinery was a new subjective force 'with a soul of its own in the mechanical laws acting through it.'[3] This introduction of machinery required 'the substitution of natural forces for human force, and the conscious application of science, instead of rule of thumb'.[4] Marx predicted that the most complete form of machinery was the automatic system of machinery - 'this automatum consisting of numerous mechanical and intellectual organs, so that the workers themselves are cast merely as conscious linkages.'[5] Senior's predictions, and as I shall show, Babbage's

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1. Senior Papers, N. Senior, 'Lectures', Course II, Lecture 7, p.31
2. Senior Papers, N. Senior, 'Lectures', Course II, Lecture 8, p.42
3. Karl Marx, Grundrisse, tr. Martin Nicolaus, Harmondsworth, 1973, p.693
4. Karl Marx, Capital, tr. Samuel Moore and Edward Aveling, New York, 1967, i, 386
5. Karl Marx, Grundrisse, p.692

and Ure's (who also inspired Marx's technological vision) hinted at the scope of those colossal changes which inspired Marx to write of a new era where

> 'The production process has ceased to be a labour process in the sense of a process dominated by labour as its governing unity. Labour appears, rather, merely as a conscious organ, scattered among the individual living workers at numerous points of the mechanical system; subsumed under the total process of the machinery itself, as itself only a link of the system, whose unity exists not in the living workers, but rather in the living (active) machinery, which confronts his individual, insignificant doings as a mighty organism.'[1]

The social and historical view of the origin of fixed capital that interested political economists in the 1830's, also prompted them to look at alternative technologies, and to assess the conditions which influenced the choice or development of a particular set of techniques. Scrope developed ideas about the impact of wage changes under different technical conditions. In the situation where greater proportions of fixed capital were employed along with little labour a wage rise was likely to have a minimal effect on profits. In the opposite case the fall in profits would be great. Capital could be transferred from the sector dominated by one set of techniques to that dominated by another, reducing the price of goods manufactured with capital intensive methods and increasing that of the labour intensive products. Scrope, however, saw the likelihood of such a transfer as minimal. Capitalists from the labour intensive sector would have to acquire machinery at greater cost due to the rise in wages in order to function in the capital intensive sector. This would substantially reduce the level of expected profits, and thus the motives to switch techniques. The upshot of this analysis, though Scrope did not make the connection, was that dis-equilibrium in the rate of profit between sectors could be indefinite.

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1. Karl Marx, Grundrisse, p.693

The comparative and historical approach to economics gave John Rae a sense of the social determinants of techniques of production. He came to see that alternative technologies could be developed to suit different environments. Rae went further and posed the idea that the efficiency of techniques was not technically but socially defined. It was thus that he came to distinguish the production conditions of intensive agriculture from those of extensive cultivation.

> 'A English farmer ... who comes to North America to pursue his art, almost always commences on the system which he followed in Britain. His agricultural implements, his harness, his carts and waggons, etc. are all of the most durable and complete, and therefore, of the most expensive construction, and his fields are tilled as laboriously and carefully as were those he cultivated in his native land. Some time usually elapses, before he discovers that he might do better by being content with more simple, and less highly finished implements, and that it will be for his advantage to cultivate ... less laboriously, though not less systematically. His neighbours tell him indeed from the first, that if he expects the same profits as they have, he must have less dead stock on his hands, and must give more activity to his capital; but he is slow of believing them.'[1]

It is true, however, that any notice taken of the choice of techniques was only to add evidence to the belief that the most capital intensive techniques in a society dominated by the accumulation of capital indicated the highest stage of development. Robertson affirmed the pervasive fusion of the accumulation of capital and best practice techniques:

> 'By means of an abundant capital, the makers of machinery likewise are enabled to provide the most suitable materials and the most expert workmen, for constructing what their employers consider best calculated for the proper performance of the work in contemplation.'[2]

John Rae, too, connected the social conditions conducive to the accumulation of capital with those conducive to the invention and introduction of machinery. Accumulation was helped by these factors: a concern for the future welfare

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1. John Rae, New Principles, p.207
2. G. Robertson, Essays on Political Economy, p.353

of society which allowed for programmes of investment in social overhead capital; intellectual awareness and reflection on future needs; and social stability. The motivation for the introduction and invention of machinery was similar. But Rae did notice a key exception. As discussed above, few of the political economists made any distinction between inventors and innovators. Rae, however, did notice that the distinction mattered. Capital accumulation and the innovation of techniques suffered from any disturbance in the social order. But it was precisely this disturbance that stimulated scientific advance.

> 'Men are so much given to learning, that they do not readily become discoverers. They have received so much, that they do not easily perceive the need of making additions to it, or readily turn the vigour of their thoughts in that direction ... Whatever, therefore, breaks the wonted order of events, and exposes the necessity or the possibility, of connecting them by some other means, strongly stimulates invention.'1

Machinery was also connected to the accumulation of capital in another way. John Rae laid bare the social relations generated by their dual development. It was in the nature of progress to convert the original simple tools into more complex machinery.

> 'And so it is with all our implements, they are passing on to great machines. This process can be averted by no conceivable process that would not have the effect of fettering all the active powers of humanity.'2

This raised the question 'cui bono.' With the accumulation of capital it was obvious that the 'former artisans, in giving up their tools have never become the owners of the machines that have succeeded them'. Rae concluded that machinery and factories came to be owned by a particular class - 'the operative ... owns nothing but his hands and the art of using them fitly.' The artisan was forced to sell his labour to the owner of the machine and

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1. John Rae, New Principles, p.223
2. John Rae, 'Essay on Education' (1843), The Sociological Theory of Capital, ed. C. W. Mixter, p.235

was degraded in social status.

> 'Formerly he was a small capitalist, now it is the characteristic of his condition to be a mere operative, destitute of capital.'[1]

Rae compared the 'industrious apprentice' to the 'present factory boy' and predicted the fate of handicraft manufacture after the current 'revolution' in industry.[2]

The Savage Mind and Civil Society

A remarkable theme running through the political economists of the 1830's was the idea of contrast between their own economy and that of primitive cultures. The analysis of technical change and the accumulation of capital was coloured by images and backed up by hypothetical history and the anthropological findings of the period. Economists of the period had a great deal to say about primitive economies, but the emphasis was on the contrast with industrialized society and not on the development of those cultures in themselves. Burrow has blamed the lack of understanding in this period of the alien and the primitive on the narrowness of utilitarianism and political economy which produced an atmosphere of dogmatism.[3] Yet, increasingly, there was direct contact with the problems of alien cultures, and greater interest in collecting data to reinterpret concepts of society and social change.[4] The fact that political economists now took their examples from anthropology and from the data of the slavery debates makes it obvious that something of appeal must have been available. It also indicates a certain shift in political economy to a more self consciously historical and comparative discipline. The changes that were taking place in the anthropology drawn on by political economy were reflected

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1. John Rae, 'Essay on Education' (1843), The Sociological Theory of Capital, ed. C. W. Mixter, p.235
2. ibid., p.236
3. J. W. Burrow, Evolution and Society, Cambridge, 1970, p.77
4. ibid., p.78

in its own transformation.[1] Anthropology from the 1830's onwards was feeling the impact of a re-orientation in the life sciences and geology. These were becoming infused with a historical perspective. This was completed in the latter half of the Nineteenth Century with the entry of the theory of evolution.[2] It is striking, however, that the critique of Ricardo in the 1830's was developing in its method and approach along very similar lines as developments in anthropology and the life sciences. Scrope was only an ideal example of the connection between the disciplines. His geological work has been credited with laying the basis for Lyell's Principles. Scrope generalized a new idea of time and evolutionary change. His demonstration of the progressive stages in the development of the earth's surface were compatible with his views on the historical development of capitalist society.

> 'Just as the causation of geological events, however unusual, was referable to the ordinary laws of nature, so Scrope believed that the most effective political economy would be one based on the 'natural laws' of social welfare ... Just as the general "invariability" of the laws of nature was in no way contravened by demonstrating that the earth had "passed through several progressive stages of existence in the past," so the detection of laws of social behaviour was compatible with an optimistic outlook for the future progress of

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1. Little of the writing about Africa in the early years of the Nineteenth Century was politically neutral. It was dominated by debates between slavers and anti-slavers. Anthropology, at its barest beginnings, was still divided between biology and moral philosophy. The first anthropological societies came from a merger of J. C. Prichard's biological orientation with the political concerns of the humanitarians. Dr. Thomas Hodgkin, a Quaker humanitarian, Professor of Anatomy at Guy's Hospital and a friend of Prichard's began to supply the 1837 Parliamentary Committee on Aboriginees with ethnographic data. Out of this he formed a permanent organization, the Aboriginees Protection Society, to study the Aboriginees. See Philip Curtin, The Image of Africa, London, 1965, pp.217 and 329 - 333
2. See Gay Weber, 'Science and Society in Nineteenth Century Anthropology', History of Science, xii, 1974, and R. M. Young, 'Malthus and the Evolutionists. The Common Context of Biological and Social Theory', Past and Present, 43, May, 1969.

> mankind. And at the deepest level, just as Scrope wished his geology to demonstrate the overall providential design behind the law bound progressiveness of the earth's history, so also he wished his political economy to vindicate the providential character of the world of human affairs by refuting the gloomy predictions of the Malthusians.'[1]

Ideas of the development of primitive economies were culled from the prevailing attitudes in ethnography and travel literature. As Gellner puts it, what dominated was a theory of primitive mentality as steeped in intellectual error.[2] Nineteenth Century thinkers had an evolutionist vision of continuous growth, and used the contemporary primitive culture as a fossil of their own society.

Nineteenth Century discussions of primitive societies also seem to have taken their departure from the Eighteenth Century image of barbarism. The social theorists of the Scottish Englightenment had a stages theory of progress with savagery and barbarism as the lowest stages. Most of these writers believed in the positive development of humanity and they ascribed the superiority of contemporary European society to the existence of certain important socio-economic institutions and phenomena such as property rights, inequality, and the accumulation of capital.[3] David Hume, for instance, identified white man with civilization and argued that among other races there had been no ingenious manufactures, arts nor sciences.[4]

These theorists interpreted development in the pre-commercial stages in terms of the categories appropriate to contemporary capitalism. It was their view that wealth grew, not because society adopted successively higher modes of subsistence, but because, within the framework of these modes of subsistence, there was a gradual increase over time in the division

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1. Martin Rudwick, 'Poulett Scrope on the Volcano of Auvergne', British Journal of the History of Science, 1975, p.238
2. E. Gellner, Legitimation of Belief, Cambridge, 1974, pp.149 - 152
3. Ronald Meek, Social Science and the Ignoble Savage, Cambridge, 1975, pp.117 and 153
4. Philip Curtin, The Image of Africa, p.42

of labour, exchange, and the accumulation of capital.[1] These ideas, indeed, reflected the concerns of the newly industrializing British economy. The crucial shift to civilization was seen to coincide with a value set on labour. This coincided with an explicit theme in late Eighteenth Century thought - the need for disciplined and regular wage labour in British industry.[2]

The stages theory was developed and adapted by the Nineteenth Century inheritors of the Scottish tradition. James Mill made overt use of these philosophical principles to write his History of India. Mill ranked cultures by their achievements, and had great contempt for 'degenerate' Hindu society.[3] He also believed that Africa illustrated the earlier stages through which India had passed. The comparative and historical analysis of many of the economic theorists of the 1830's also owed much to the Scottish tradition. Many of these, like James Mill, had been educated in the Scottish universities, and had attended the lectures of Dugald Stewart.[4]

This apparent continuity between Eighteenth and Nineteenth Century ideas would seem to contradict Burrow's case for the death of conjectural history and the Scottish mode of thought at the end of the Eighteenth Century. But, in fact, for a host of reasons not mentioned by Burrow, intellectual conditions from the 1790's radically altered the Scottish legacy.[5]

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1. Ronald Meek, Social Science, p.222, and Andrew Skinner, 'Adam Smith, an Economic Interpretation of History', in A. S. Skinner and Thomas Wilson, Essays on Adam Smith, Oxford, 1975.
2. Philip Curtin, The Image of Africa, p.62
3. William Barber, British Economic Thought and India, Oxford, 1975, p.129 For a discussion of the bearing of James Mill's intellectual formation on his History see Duncan Forbes, 'James Mill and India', The Cambridge Journal, v, Oct., 1951.
4. Philip Curtin, The Image of Africa, p.250. Among others from the Scottish universities were John Rae, Samuel Read, and Robert Hamilton, professor of mathematics at Marischal College, Aberdeen.
5. I owe this suggestion to John Robertson.

One of these factors was a shift of ideas of society to a more materialist analysis, to the realm of the physical and the natural. The Scottish account of the evolution of society had its foundation in a theory of social change. Social change in the Nineteenth Century came to be based on a theory of nature.[1] It was this shift from the social to the natural sphere along with the political issue of slavery which brought political economy into contact with the discipline of anthropology emerging from this shift in emphasis. This places in focus my earlier discussion of the relationships between the outlook of political economy and that of the life sciences.

Political economy also became integrated with the stirrings of the missionary movement. By the 1830's this movement was combined with projects for 'legitimate trade'. The work of the 'colonial reformers', including Wakefield, Torrens, and Merivale was adapted to the situation of Africa. Legitimate trade became the route for stimulating 'mental powers', for precipitating the division of labour, and for cultural and technological diffusion.[2]

The role that savages played in early Nineteenth Century thought was perceptively uncovered by one of the colonial reformers, Herman Merivale. Merivale made the telling criticism that savages were of great use to political economists and political philosophers. Their culture was 'a sort of zero in the thermometer of civilization'. It gave some scientific status to a theory of the gradual rise towards perfection. Merivale did not doubt that the model was of value in hypothetical reasoning, but argued that historically it was false. Merivale's own diffusionist approach reflected the assumption of a great divide between primitive and modern

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1. See Gay Weber, 'Science and Society in Nineteenth Century Anthropology', pp.264 - 265
2. Philip Curtin, The Image of Africa, p.428

cultures, or what Levi-Strauss calls 'a level plain between two ascents'.[1]

> 'We do not know a single instance of a savage tribe raising itself by unassisted efforts to a state of civilization. This has always been effected by foreign emigration from a more civilized state.'[2]

Almost all the theorists discussed in this chapter had implicit social theories and models of underdevelopment. Senior distinguished savage man by his lack of abstinence. The savage exercised labour and providence. But the pre-requisite for a rise from hunting or fishing to a pastoral, then arable phase, was abstinence.[3] Similarly Rae produced the example of the American Indian whose concern for future welfare was seen in terms of the tribe. In this situation 'prudence and foresight' could have little effect on the future welfare of the individual. In any case, the direction of events was obviously beyond the control of the hunter in the woods.[4] If economists could define modern man on the basis of his capacity for abstinence, then it is not surprising that they also defined 'the modern economy' in terms of its fixed capital and machinery. In a savage state labour could acquire only minimal productivity because of lack of fixed capital. Scrope argued that

> 'by practice, and the exercise of his native ingenuity, in ... and fabricating instruments, a clever savage may increase the productiveness and reward of his labour far beyond that of his companions'.

But this allowance for some form of advancement was set up by Scrope only as a contrast to the much better conditions of even the lowest level labourer in a civilized society. Modern society was distinguished by its accumulation of fixed capital.[5] Scrope also defended the diffusionist view. He found it

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1. Quoted in E. Gellner, The Legitimation of Belief, p.153
2. [H. Merivale], 'Definitions and Systems of Political Economy', Edinburgh Review, Oct., 1837, p.90
3. N. Senior, Outlines, p.69
4. John Rae, New Principles, pp.131 - 132
5. G. P. Scrope, Principles, p.88

quite easy to dispose of Whately's platonic conception that man was created with innate knowledge and was unconvinced by his idea that present day savage tribes were in a state of deterioration.[1]

The savage was also a tool for both those who espoused a social theory of ranks and those who claimed a theory of social classes. Whately drew on the work of the physical anthropologists James Cowles Prichard and Dr. Taylor, and used as his examples the Indians of New Guinea, the natives of Pellew Islands and the American Indian. He postulated a series of gradations between the highest and the lowest state of human society. He compared the conditions of those on the bottom rungs of this ladder to 'as low a state as some tribes with which we are acquainted'. Both were incapable of any improvement by their own unassisted efforts.[2] As pointed out above, Hamilton's definition of primitive culture was expressed as a state lacking distinctions of rank and fortune, and the force of emulation. Lloyd contrasted the societies of the Otaheiti and the Hayti to prove that the inequality of property encouraged the production of luxuries and conveniences.[3] But he revealed the essential class nature of the production process in a way no other economist of the period did. He made very little of the difference between free labour and slavery.

'Whether the system of free labour or of slavery be

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1. G. P. Scrope, Principles, pp.259 and 260
   Whately's view was derived from the traditional monogenetic explanation of race. This was the view that God had created man in his own image. Varieties of race other than those of western civilized man were regarded as degenerations from original stock. This attitude was resurrected in W. Cooke Taylor's Natural History of Society (1841) which argued that man had originally been endowed with a knowledge of agriculture and mineralogy, but some had slipped back down to barbarism, while others had known progress. See Philip Curtin, pp.41 and 391
2. R. Whately, Introductory Lectures, p.127 and Lecture V
3. As far back as the 1750's, Turgot had made similar arguments. He believed that inequality was the necessary precondition for the extension of the division of labour, exchange, commerce and the accumulation of capital. See Ronald Meek, Social Science, p.71

> established, we may equally find a class of society enjoying, without personal labour, the necessaries, conveniences, and luxuries of life, and another class performing the labour requisite for purchasing these necessaries, conveniences, and luxuries at the hands of nature.'[1]

This analogy between the exploitation of capitalist and slave societies was tempered by the attempt to discover which form of exploitation was most favourable to growth. The case that slave labour was more inefficient than free was a part of the armoury of the humanitarian cause in the anti-slavery debates. Scrope developed this form of argument using Richard Jones' work on types of agricultural labour. It was his characterization of the cottier that

> 'Poverty, the constant fatigues of laborious exertion, and the grasping blindness of his landlord, put both science and the means of assisting his industry by the accumulation of capital out of reach of the peasant. And from the landowners themselves it is vain to hope for either much steady superintendence of cultivation, or the accumulation of capital. They are not a saving class.'[2]

Scrope later went on to trace the different patterns of development between the East and the West. The pattern of land occupation constituted the basic difference. From this he traced the slow shift from serfdom to free tenancy, the object of which was to 'encourage the industry' of the cultivator by guaranteeing 'some return for his efforts'.[3] This transition from servitude to free labour was achieved by force, but liberty and pauperism grew up together. Scrope blamed the contradiction on the management of the poor laws. These were left to the magistracy and landed groups, precisely those elements which had an interest in keeping wages low and rents high. He accused them of 'forcibly metamorphosing the whole labouring population

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1. W. F. Lloyd, Two Lectures on the Justice of Poor Laws, p.17
2. /G. P. Scrope/, 'Jones on the Doctrine of Rent', Quarterly Review, 1831, p.91
3. G. P. Scrope, Principles, pp.117 - 123

into paupers'.[1]

Political economy in the early 1830's gathered together the strands of thought defining civil society. Civil society was the most advanced form of society developing over time, and it acted as the cocoon for the protection and nourishment of fixed capital. It was the assumption of political economy that the historically unprecedented role of fixed capital was socially determined by a class structure and ideologically extended by the state. Read, Hamilton and Rae all limited the role of the state to paving the way to new inventions and new ways of acquiring fixed capital.[2]

The social assumptions behind these models are clear to us, but with hindsight. The appeal to anthropology was a way of writing political economy, which along with other factors, gave it a more scientific posture. The volume of scholarly work on the savage gave scientific status to a theory of the gradual rise towards the perfection of industrial capitalism. The substance of the anthropological model itself was value laden, but it entered into political economy under the guise of objective judgement.[3]

There were several ideological overtones to the historical and comparative models of capital formation in the 1830's. There was a definite analogy, current in the work of social reformers, between the savage and the poor and unemployed.[4] Kay Shuttleworth, then Chadwick developed themes of social disease and urban degeneracy endemic to industrialism. Neither of these, however, challenged the industrial system. They, too, echoed support

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1. G. P. Scrope, Principles, p.312
2. Robert Hamilton, The Progress of Society, pp.48 - 54; John Rae, New Principles of Political Economy, p.198; Samuel Read, Natural Grounds of Right to Vendible Property, pp.35 - 40
3. The creation of anthropology as a 'neutral' science with a normative social context is discussed by Gay Weber, 'Science and Society', p.273
4. This point is made by Gay Weber, p.278

for the introduction of machinery.[1] Certainly, the social reformer found his kinfolk among the missionaries to Africa and Asia, and among the scientists who encouraged them.

This social analogy between savages and the outcasts of advanced industrial society was, however, only the surface of much deeper concerns within political economy. I have shown how, for many of these economists, the savage represented a type of 'fossil' to Nineteenth Century British culture. These economists had distinguished the savage by his lack both of abstinence and of the institutions of private property. But the idea of the savage also went along with a definite change in ideas about labour in an industrial system. Just as the savage was regarded as a relic, so now was the ingenious artisan. John Rae traced with regret, the transformation of the artisan into a 'mere operative'. These theorists saw the first transition, in their own time, of vital aspects of the work process. The new face of technical change was fixed capital and machinery. The labour that went with this was not that of the craftsman, but that of the factory hand. Some, indeed, feared explosive consequences from this process. Hamilton noted that the complex division of labour entailed by technical change had both made workers increasingly inflexible and had gathered them together in large factories, full of sophisticated machinery. This labour was now simply the appendage of machinery, but its concentration allowed a basis for political organization. The result, he predicted, was that in such a setting any sudden introduction of new fixed capital which substituted for human labour would create struggle in the factory and lead to the 'destruction of machinery'.[2]

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1. See James P. Kay, The Moral Condition of the Manufacturing Population, Manchester, 1834, p. 87. Cf. Chadwick's question to the Political Economy Club on Smith's views of the excessive division of labour. Noted above p. 133 of this thesis.
2. Robert Hamilton, The Progress of Society, p. 359

This change in the idea of labour was also reflected in middle class attitudes to workers' education. I will say much more of this in a later chapter on the Mechanics Institutes Movement. Suffice it to say that these early campaigns for an appropriate vocational education had their counterpart in plans for the training of 'savages'. There were demands in the late 1830's and early 1840's for instruction in agriculture and the mechanical arts for the African natives. But this was to be only an adequate education for an inferior people. It was proposed that industrial training be limited to such an extent that Africans should be taught to repair, but not to manufacture the industrial products of England. Education was to consist of religious instruction along with agriculture for boys and domestic science for girls. Its object was to provide a docile workforce.

> 'The children were to be "taught habits of self control and moral discipline". They were to be instructed in "the mutual interests of the mother-country and her dependencies; the rational basis of their connection, and the domestic and social duties of the coloured races". Their education in economics and politics was to include "the relation of wages, capital and labour, and the influence of local and general government on personal security, independence, and order".'1

On the British scene, the mere operative and the factory hand were concepts proceeding out of a political economy which gave an unprecedented role to the abstaining capitalist and predicted gains from greater capitalist control of the production process. This set of economists had little say about the implementation of this control in the organization and pace of work, and in the definition of skill. But some of their more isolated contemporaries such as Richard Jones, and their more popular apologists such as Charles Babbage and Andrew Ure, did.

The next two chapters will deal in depth with these theorists who

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1. Philip Curtin, The Image of Africa, p.427

extended the discussion of technology into views of wider social change and into the practical problems of workshop and factory.

CHAPTER FIVE

The Cambridge Critique

The historical and comparative approaches implicit in the work of the theorists of the 1830's found their basis in the popular attempt to undermine the conclusions of Ricardo's model. Much of this criticism, as I have shown, was based on a misunderstanding of the structure and intent of the Ricardian system. However, the alternative focus of the theorists of the 1830's generated primary interest in fixed capital, in technical innovation in manufacturing, and in the developmental 'evolutionary' process of growth. These interests were reinforced and complemented in the work of the Cambridge Inductivists, a group of theorists who investigated the institutional and organizational aspects of growth and technical change. This same group of theorists also proclaimed a new scientific methodology. Political economy, like all other natural and social sciences, was to be based on the collection of facts and the statistical inquiry. The Cambridge Inductivists made these research strategies their own to a much greater extent than did any of their contemporaries, most of whom were at least sympathetic to some broadening of political economy along these lines. The political economy of modern industry, complemented by the Cambridge critique, seemed, indeed, to contain many of those elements usually identified with the late post Darwinian part of the Century.

The basic objects of the economic theory of the Cambridge Inductivists were to show that industrial and especially agricultural improvement would lead to increasing returns, to define the social and institutional constraints of categories and theories, and to reassert Smithian and Malthusian methodologies.

The Cambridge school was not in any concrete sense, a school of

political economy, but rather a loose network of scientists and economists who were either friends or sympathizers. It is important to note that though the group was integral and, indeed, formative to the scientific movement of the period, it remained rather isolated from the main circles of political economy. The members either worked together in empirical scientific organizations or showed similar interest in promoting a grand programme for the introduction of inductive approaches to the sciences and economics. The group, however, did play a substantial part in creating the atmosphere and conditions for a broadly based critique of Ricardo, one ranging through other social sciences and reaching as far as popular political economy, generated from within provincial science and social science societies. The two key members of the group were William Whewell and Richard Jones.[1] Other members I have connected with this group are largely identified according to Whewell's long term correspondence with them. Whewell and Jones were involved in an undergraduate association devoted to Baconian ideals. Herschel, Babbage, Peacock, and Airy were also involved, and most participated in Babbage's Analytical Society which set out to

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1. Whewell entered Trinity College, Cambridge in 1812 and continued as a Fellow of the College after he graduated in 1816. In 1820 he became Fellow of the Royal Society. He worked over an enormous range of fields including history and philosophy of science, economics, mathematics, crystallography, geology, mineralogy, and tides. He was master of Trinity from 1841 - 1855, and held the chairs of Mineralogy, then Moral Philosophy. See Isaac Todhunter, William Whewell, an Account of his Writings, London, 1876. Richard Jones was a student at Caius, Cambridge from 1812 to 1826. In 1833 he became professor of political economy at Kings College, London, and in 1836 succeeded Malthus as professor of political economy at Haileybury College. He became a Tithe Commissioner and assisted in the passage of the Tithe Commutation Bill in 1836. Richard Jones, Literary Remains, consisting of Lectures and Tracts on Political Economy, ed. William Whewell, London, 1859, pp.xx - xxv

propagate the methods of analysis of Lagrange and Laplace.[1]

The Analytical Society was followed by the Cambridge Philosophical Society as the key organization for the aims of the set. The Cambridge Philosophical Society was founded by Sedgwick, E. D. Clarke, and John Henslow.[2] Between 1819 and 1850 seven out of the nine secretaries of the society were Sedgwick, Henslow, Peacock, Whewell, Willis, Hopkins and Miller,[3] and eight out of eleven of the papers in volume I of the Transactions were written by Herschel, Babbage, Whewell, Sedgwick and Clarke.[4] The commitment holding the group together was to rebuild all the sciences including economics on axioms reflecting a more careful and extensive study of the facts. Whewell wrote most of the methodological and polemical tracts of the group. And Richard Jones received support from the group in his efforts to overturn Ricardo's deductive economics and replace it with his own. Whewell's friendship with Jones took shape in these theory groups. But there was a long background to their interest in the project of an inductive political economy. Jones' Essay on Rent of 1831 was the substantive theoretical work that came out of Whewell's encouragement and prodding from as early as 1822.[5] Whewell produced a series of mathematical papers on economics between 1829 and 1850. He also wrote a number of methodological

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1. See Charles Babbage, Passages from the Life of a Philosopher, London 1864, p.29. The reading done in mathematics by this group suggested to Babbage the idea of translating Lacroix's book on Differential and Integral Calculus. The group's work took the usual rhythm of university societies. Babbage notes 'some idea may have occurred to several colleagues of the Analytical Society, but most were so occupied first with their degree, and then with exams for fellowships that no steps were taken by any of them on this.'
2. Sedgwick was professor of geology. Clarke was a mineralogist, and Henslow a botanist. See Walter F. Cannon, 'History in Depth: The Early Victorian Period', History of Science, 3, 1964, 20 - 27
3. See Walter F. Cannon, 'Scientists and Broad Churchmen, an Early Victorian Intellectual Network', Jrl. Brit. Stud., December, 1964.
4. ibid.
5. Whewell to Jones, 4 Nov., 1822, Whewell Papers, Trinity College, Cambridge.

pieces, and printed a series of lectures in 1860.[1] Finally, he attempted to collect Jones' scattered notes and lectures to edit the Literary Remains in 1859. Whewell and Jones, however, saw their influence reaching further by identifying themselves with others who were writing on political economy with similar criticisms. Aside from their assumed heritage and thwarted coalition with Malthus, they identified with their cause T. P. Thompson, whose True Theory of Rent contained many criticisms similar to Jones'. Babbage's work on The Economy of Machinery and Manufactures was not taken very seriously by them, but Jones did see some identification in their work on 'auxiliary capital'.[2] And finally, John Cazenove, who had supported Malthus in debates inside the Political Economy Club, took part in editing Jones' Literary Remains and supported the propositions of the group in his later work.[3] These latter members of the network were, however, all really conceived of as sympathetic contacts rather than key theorists intent on changing the Ricardian orthodoxy. It was Whewell and Jones who set themselves up to provide the systematic theoretical work that was fundamental to any possibility of a new orthodoxy. The outcome was not great, but it cannot be denied that Whewell did try very hard to prod his dilatory friend into working out his ideas and publishing.[4]

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1. See 'Mathematical Exposition of Some Doctrines of Political Economy', Trans. Cambridge Philosophical Society, iii, 1830; 'Mathematical Exposition of Some of the Leading Doctrines in Mr. Ricardo's Principles of Political Economy & Taxation', Trans. Cambridge Phil. Soc. iv, 1831 and 'Mathematical Exposition of Certain Doctrines of Political Economy', 2nd and 3rd Memoirs, Trans. Cambridge Phil. Soc., ix, 1856.
2. See 'On the Use of Definitions', Philological Museum, ii, Cambridge, 1833. 'Political Economy as an Inductive Science', On the Philosophy of Discovery, London, 1840. 'Lectures' in Whewell Papers.
3. John Cazenove, ed. T. R. Malthus' Definitions in Political Economy with Notes, 1843; and An Elementary Treatise on Political Economy; or a short Exposition of its first and fundamental principles, London, 1840.
4. Trinity College, Cambridge, (Whewell Papers). See letters from Whewell to Jones on 7 Dec., 1820, 4 Nov., 1822, 17 Oct., 1825, 10 Sept., 1827, 9 Sept., 1828, 15 July, 1831, 9 Oct., 1831, 19 Feb., 1832, and 27 Dec., 1832.

Cambridge Economics

The attempt to establish a heritage in Malthus' critique of Ricardo was of high priority to the inductivist critique. Whewell had always had a high regard for Malthus' political economy. He regarded Malthus' method and his empirical work on population as a good example of some of the work expected from the inductivist platform. And Whewell tried frequently to interest Malthus in the work of the group, and to mobilize his active support. Whewell sent him Jones' Essay on Rent and some of his own mathematical and methodological pieces. The replies were anxiously awaited. Jones wrote to Whewell in 1831 after his book had been submitted to Malthus.

> 'I rely on hearing from you if Malthus gives any sign - or indeed if you have anything worth telling about the probable destiny of your foster child.'[1]

Jones' reaction to Malthus' assessment of his work shows equally the reliance on Malthus' patronage and almost supervisory role. Jones, in the midst of writing a letter which he directed Whewell to show to Malthus, exclaimed:

> 'I was gratified by his letter, but merciful powers on what sort of dreary land of speculation does he urge one to enter - rents in America! ... as I admire and esteem Malthus, he shall provoke me into no balloon excursions ... '[2]

And Whewell himself, who had initiated all contact with Malthus, sought repeatedly to identify his friend with the traditional critic of Ricardo.

> 'I have no objection to your calling those people metaphysical in the scurrilous meaning of the word ... But never mind if other people call you so - being well assured that you and Malthus belong not to the metaphysical, but to the ethical school of Political Economy.'[3]

And later when Whewell was upbraiding Jones for relapsing into looking for definitions of terms, he reprimanded thus:

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1. Whewell Papers, Jones to Whewell, 24 Feb., 1831.
2. Whewell Papers, Jones to Whewell, 4 March, 1831.
3. Whewell to Jones, 16 Aug. 1822 in Isaac Todhunter, William Whewell, ii, p.49

> 'A proper business indeed it would have been if you had written to Malthus! He I dare say, would have given in to your folly, and at this very time you would have been arguing the matter with him and fancying yourselves most usefully employed ... '1

This dependence on Malthus is a curious figment since Malthus rebuffed overtures on quite fundamental grounds. Whewell's mathematical paper endorsing T. P. Thompson's Theory of Rent resulted mainly in Malthus' patronising criticism of Thompson. Jones' Essay on Rent provoked Malthus into clarifying his position of basic support for the Ricardian analytic structure. In answer to Jones' book and Whewell's overtures, Malthus made reference to the debate on the current status of Ricardian economics which had just taken place in the Political Economy Club

> 'I confess I felt that when I almost stood alone in my differences with Mr. Ricardo and was compared to Dr. Priestly amidst the new discoveries in chemistry, it would not finally be so. But I was hardly prepared to expect that in so short a time as has since elapsed, one of the questions in the Political Economy Club should be "Whether any of the principles first advanced in Mr. Ricardo's work are now acknowledged to be correct?" My apprehension at present is that the tide is setting too strong against him; and I even think that Mr. Jones is carried a little out of the right course by it. In his zeal to shew that Mr. Ricardo is quite wrong, which he certainly is, in dwelling upon the diminished returns of agricultural capital as the sole cause of increasing rents, he seems inclined to deny the undoubted truth of the natural tendency to such diminished returns in a limited space, unless prevented by improvements in agriculture or manufactures.'2

If this was the extent of Malthus' support of the school, then there must have been more than reasons of substantive theory for the close relations sought by the inductive school. Neil de Marchi argues that Malthus was important to the group because he was an authoritative voice within the Political Economy Club. But the Political Economy Club gave no specific authority, nor is it likely that it would have provided in itself any

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1. Whewell to Jones, 11 Feb., 1833 in Isaac Todhunter, William Whewell, ii, p.156
2. Malthus to Whewell, 31 May, 1831, Whewell Papers. Also see N. de Marchi and Paul Sturges, 'Malthus and Ricardo's Inductivist Critics', Economica, Nov., 1973, 391

discussion or wider acceptance of Jones' views. Leading theorists were brought to the club, not made there. There was, however, a much more basic reason for the connection with Malthus. Malthus had been Ricardo's primary critic, and he appeared to those such as Whewell as the authority of dissent from Ricardian economics per se.

Political economy was the only field outside of the natural sciences where Whewell could find work of an inductive nature. Even then, he could identify as examples of this only Jones' book and Malthus' work on population.[1] The method of induction appealed to by Whewell and Jones was not that type narrowly defined by John Stuart Mill. Rather, induction was based on the collection and classification of fact. From the level of empirical generalization one could proceed to more comprehensive and inclusive generalization. One proceeded in gradations from lower order to higher order generalizations. Since theory proceeded from the premises, the empirical foundation of assumptions was of first importance.[2]

The invocation of Smith and Malthus also structured the criticism of Babbage, T. Perronet Thompson and Cazenove. Babbage scoffed at the 'closet philosopher' - those political economists 'too little acquainted with the admirable arrangement of the factory'. Smith's analysis of the division of labour should be extended and 'no class of persons can so readily, and with so little sacrifice of time, provide the data on which all the reasonings of political economists are founded, as the merchants and manufacturers.'[3] T. Perronet Thompson saw himself as upholding Smith's theories of rent against Ricardian distortions. His 'true theory of rent' was so named as a

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1. Whewell, however, excluded Malthus' anticipatory thesis, that is, of geometric population increase, the only view generally associated with Malthus.
2. See de Marchi and P. Sturgess, 'Malthus and Whewell's Inductivist Critics', also see Whewell's preface to the Literary Remains, pp.x - xi
3. Charles Babbage, On the Economy of Machinery and Manufactures, London, 1832, p.119

part of the linguistic ploy of identifying his own work with the accepted Smithian tradition. Malthus saw through Thompson's direct aim, but missed the point of his approach when he repudiated the 'true theory' as simply another 'new theory'.[1] Cazenove placed himself firmly in the Malthusian tradition, carrying over not only the methods, but the principles of Malthusian theory.[2]

It is notable that one other method of criticizing the orthodoxy was taken up by the inductivists, and this was the mathematical approach. The possibilities of using this as a mode of expression for the introduction of any new orthodoxy were, however, strictly limited. But this was for reasons other than methodological concerns. The case for using the mathematical form of critique was in fact extensively discussed. Whewell commented on such mathematical papers given to the Cambridge Philosophical Society over the period from 1819 to 1826.

> 'Though it may well be considered a futile attempt to bring to calculation the actions of men and of bodies of men, yet it is by no means unimportant that the consequences of the best received principles and opinions of politics should be derived by the shortest and quickest methods - these methods are often of mathematics and this labour it seems more natural to expect from young economists who have gone through the discipline of our institution, than from any other class of persons.'[3]

Whewell wrote two such papers himself shortly after this - his 'Mathematical Expositions of Certain Doctrines of Political Economy' of 1829 and his 'Mathematical Exposition of some of the Leading Doctrines in Mr. Ricardo's Principles' of 1831. He saw this first article as mainly

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1. See Malthus to Whewell, 26 May, 1829, de Marchi and Sturgess 'Ricardo's Inductivist Critics', 388
2. He restated Malthus' theory of value, his theory of unproductive expenditure, and his theory of gluts and machinery. See Outlines of Political Economy, London, 1832, and Considerations on the Accumulation of Capital, 1829. John Cazenove, Outlines, pp.1 - 11
3. Whewell Papers. Whewell's Manuscript Speech to the Cambridge Philosophic Society.

'Thompson's book on rent translated into formula', and his object in applying mathematics in this case was to separate difficulties of calculation from difficulties of analysis.[1] But Whewell did, in his first papers, set out very carefully the conditions under which he used mathematical economics. Calculation problems were a major reason for this. A systematic mathematical form would clarify argument and either dispense with, or explain the position of much confused numerical calculation. The axioms of this system were borrowed from 'moral and social principles', but once these were stated they could be subjected to calculus, and the results of the assumed principles logically derived. The main usefulness of the exercise was in separating the 'business of proving assumptions' from that of 'deducing the conclusions'.[2]

The deductive and abstract form of this type of criticism would seem to be contradictory to Whewell's polemics on the method of induction. But he saw the purposes of his work as very limited in scope. His expositions were not to give any mathematical certainty to the results, but to find fault with the premises of the Ricardian principles. Only if the postulates were true would the results be verified.[3] Whewell found support for his approach in the ideas of T. Perronet Thompson, but tempered any claims he may have had for the significance of his own work after the caustic remarks of Jones. Thompson was pleased with Whewell's 'Mathematical Exposition of Certain Doctrines of Political Economy' and 'foresaw it having a great effect in placing the doctrines of political economy generally on the footing of mathematical demonstration'. Jones, however, 'kept the limits clear' by writing to Whewell:

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1. Whewell Papers. Whewell to Jones, 5 March, 1829.
2. William Whewell, 'Mathematical Exposition of Certain Doctrines of Political Economy', Trans. Cam. Phil. Soc., 1830, p.192
3. Trans. Cam. Phil. Soc., 1831, p. 197

> 'You are aware that I am not very sanguine as to the success of any attempt at mathematical reasoning to do more than point out logical errors, but I do not perceive that you profess to do much more.'1

Whewell also received tentative but critical support from Malthus, who recognized the advantages of mathematics in determining the 'different degrees in which certain objects are affected, under different hypotheses', and in establishing the results of such problems as the 'most favourable division of landed property ... the most advantageous proportions, in which the whole product of capital should be divided between the capitalists and labourers'.[2] But he had strong doubts as to the sufficiency of the data for stating propositions distinctly in mathematical language.

In his exposition of Ricardo's doctrines, Whewell sought only to see to what extent those portions of Ricardo attributed to be of scientific form could be submitted to mathematical investigation. He formalized the postulates of Ricardo's system, and combined this with criticism of Ricardo's principles. Two areas he investigated here were Ricardo's concept of progress and the relationship of the introduction of machinery to the formation of prices. Ricardo, as Whewell expressed it, saw the increase of population and the consequent extension of agricultural labour to less productive soils as the necessary and universal progress of nations. His error, however, was not one of assumption, but deduction. Ricardo had neglected the effects of increasing productivity in agriculture, 'which

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1. Whewell Papers. Jones to Whewell, 12 June, 1829.
   Thompson also extolled the mathematical approach in some of his polemical articles. For example, he found in the faults of the Saint-Simonians 'no stronger instance of the bearing of mathematical science on political economy (in truth only mathematics applied to a particular use)...'
   See 'Saint Simonianism', in T. P. Thompson, Exercises, Political and Others, ii, London, 1842 (from the Westminster Review 1832 - 37), pp.56 - 57
2. Malthus to Whewell, 26 May 1829 in N. de Marchi and Paul Sturgess, 'Ricardo's Inductivist Critics,' p. 387

in England has been a change at least as important and as marked as the increase of population'.[1]

These mathematical exercises were continued in the Cambridge Philosophical Society not only by Whewell, but by John Tozer who formalized the debate on the impact of machinery on the condition of the working classes,[2] and also by John Drinkwater, who was later important in the Statistical Movement.[3]

The Political Economy of Nations

Richard Jones started his criticism of Ricardo from the theory of rent. Whewell regarded the theory of rent as the foundation of Ricardian economics. He thought he had found the basic error of this theory in Ricardo's neglect of technical progress in agriculture. In fact, as I have already shown, the declining margin of cultivation was not necessary to Ricardo's theory of rent. The theory of rent applied to the returns of marginal increases of capital in any process of production. Jones and Whewell, however, interpreted Ricardo to mean the full operation of his assumptions and model to the immediate situation of the agricultural sector.[4]

Jones' Essay on Rent was the first volume of a proposed Political Economy of Nations. He did not choose to write first on rent because, like Whewell, he wished to pierce Ricardian political economy at its very basis. Rather he started with rent because he believed that since most of the world

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1. 'Mathematical Exposition of Ricardo's Principles', p.169
2. John Tozer, 'Mathematical Investigations into the Effects of Machinery on the Wealth of the Community, 'Trans. Cam. Phil. Soc.', 1838. Also see his 'On the Effect of the Non-residence of Landlords on the Wealth of the Community, Trans. Cam. Phil. Soc., 1841.
3. Whewell Papers. Whewell, 'Speech to the Cambridge Philosophical Society'.
4. For work on the empirical tenability of Ricardian Economics, see Mark Blaug, 'The Empirical Content of Ricardian Economics', Jrl. of Political Economy, 1956, and Neil de Marchi, 'The Empirical Content and Longevity of Ricardian Economics', Economica, 1970. De Marchi defends Ricardo's assumptions as contingent predictions or statements of tendency. He distinguishes in Ricardo's arguments between analytical statements and historical generalizations, between explanation and prediction, and between the long and the short run period.

was still agricultural, it was the relationship between proprietors and the occupiers of the soil that determined the condition of the inhabitants and their political institutions. This study of rent was to form the basis of Jones' next projected studies on wages and profits.

Jones applied himself to the study of the institutional determinants of rent and wages. He regarded this as a study of 'what is commonly called rent and not a study of the Ricardian definition of the term'. Jones saw himself as filling out many of the criticisms made by T. P. Thompson on the 'Ricardian fallacy' of the declining margin of fertility. T. P. Thompson's True Theory of Rent was first recommended to Jones by Whewell in 1828. It is evident that Whewell did not know Thompson personally because he referred to him as 'a certain Mr. Thompson of Queens'.[1] The pamphlet was of obvious interest to Whewell since T. P. Thompson had tried to dispute Ricardo's findings by identifying countries where the declining margin of cultivation did not apply, yet where rents still arose. Thompson, too, had turned his interests to the influence of taxes, moral concerns and national habits.[2] Whewell used the pamphlet as a 'carrot' for his recalcitrant friend. Thompson's views showed 'how nearly ready the world is' for Jones' book. Thompson's view of Ricardo's 'fallacy' and his interest in 'moral and national customs' was only an aperitif to Whewell. It was Jones who was 'in possession of the general views which connect and systematize these apercus', so that 'the collection of instances which illustrate them, should linger no longer'.[3]

The underlying critical point of Jones' Essay was to show that the gloom overhanging the political economy of the period was an illusion. In fact, Jones had seriously misunderstood the intent of Ricardo's model. He went on,

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1. Whewell to Jones, 9 Sept., 1828, Isaac Todhunter, William Whewell, ii, p.93
2. T. P. Thompson, 'An Exposition of Fallacies on Rents, Tithes, etc.', The Pamphleteer, 1826, p.329
3. Whewell to Jones in Isaac Todhunter, William Whewell, ii, pp.93 - 94

really at cross purposes, to argue that there was no cause for the inevitable decay in the fortunes of any class in the course of economic development. Consequently, there could be no permanent opposition of interests between classes.[1] Jones' understanding of Ricardo was that increasing expenditures of capital and labour had to be accompanied by falling proportionate returns of agricultural produce. To this Jones contrasted the barrage of his empirical and historical data. The history of crop rotations, field combinations, fertilizers and artificial grasses was evidence enough that 'the powers of the earth had come to be kept in more constant and vigorous action'.

> 'the produce of the earth, so far from experiencing a gradual diminution, is capable of being indefinitely augmented, in proportion to the increase of skill, and assistance it receives from capital'.[2]

Jones, however, did not deny that there was a conceptual limit on human skill, at which point rents would increase due to man's 'failure'. Rather, he found that the concentration on the prospects of this possibility was a 'pretty idle and useless inquiry'. What was much more important was the progress of rent before that point was reached - the inquiry into the daily spread of cultivation and the increase of capital.[3]

In all, on this subject at any rate, Jones had little more to offer than most of the critics of Ricardo in the 1820's and 1830's. All of the above criticisms of Ricardo on the basis of his theory of diminishing returns in agriculture, only went to affirm Ricardo's own repeatedly expressed belief in the great prospects of technical improvement and economic growth.

Malthus found much in Jones' Essay to comment on. The book in many ways affirmed his criticism of Ricardo, particularly on the impact of improvements

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1. Richard Jones, An Essay on the Distribution of Wealth, Part I Rent, London, 1831, p.xxxviii
2. Richard Jones, Literary Remains, p.258
3. ibid., p.595

in countervailing for a time, the Ricardian 'tendencies'.[1] The findings of Jones supported his own theories that

> 'in old States, as I have specifically stated, where neither profits nor corn wages are high, the limit to the further increase of rent from the fall of profits and wages is very narrow, and the enlarging incomes of the landlords are almost wholly derived from improvements in agriculture'.[2]

Malthus was not, however, very impressed with the group endorsement of T. P. Thompson's monopoly or scarcity theory of rents. This provoked him into pointing out that the limits on the increase of productivity were important and empirically valid. Though gradations in the soil were not necessary to the existence of rent, they did, nevertheless, occur in every country, and would, in part, determine the effect of a tax on rent. He found Ricardo's theory of rent, using corn as the standard commodity still superior to T. P. Thompson's monopoly theory using rare wine as his example.[3] The main fault Malthus found with Jones' book was that Jones appeared unwilling to admit the tendency of continued accumulation and progress of population to lower the rates of profit on corn wages and on land. Malthus, though not very supportive on the level of this basic critique of Ricardo, was, however, very interested in Jones' own theory of the comparative development of rent and of its institutional background.

For Jones was not simply involved in criticizing Ricardo. Rather, he was seeking a model which would allow for a comparative analysis of income distribution and institutions. Far more important than the mobility of capital in his system, was the impact of customs and history on land tenure. In accordance with his methodology, he took a survey of land tenure arrangements over a spectrum of countries and historical periods. He separated

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1. Again, as I have shown in Chapter 2, Ricardo entirely agreed with Malthus here.
2. Malthus to Whewell, 28 Feb., 1831, see N. de Marchi and Paul Sturgess, 'Ricardo's Inductivist Critics', 389
3. Malthus to Whewell, 26 May, 1829, ibid., 388

rents into several different categories, each of which bore differently on the comfort, prosperity and progress of each society. These divisions were serf rents, metayer rents, ryot rents, cottier rents and farmers' rents. In his later work, he found an equal variety of labour. These he classified into unhired labourers, such as peasant cultivators, paid dependents who existed on the revenue of their employers, (this covered a greater part of the non-agricultural population of Europe), and hired labourers who received their wages out of capital. Jones censured the English political economists for their very narrow conceptions. Their theory was directed to explain only the progress of farmers' rents and hired labourers - the two most numerically insignificant of all the categories.[1]

Key to the dynamics of Jones' system was a theory of history. He set out to trace the steps in the progress of society, and to observe the laws determining changes in society.[2] Capitalists, as a separate class, were not natural, eternal entities, but only emerged historically. They were gradually separated from labourers and landlords, and came to assume an increasing share in the direction of national industry, and thus greater influence in social and political affairs.[3] The distribution of income was very important to the particular form of economic development in different nations. Wages, rents, and profits contributed in very unequal proportions to the accumulation of nations at different stages. Preliminary to the accumulation of increasing masses of capital was the appearance of a wages paying class. And the influence of this class was also social and cultural.

'Such a rich and numerous body of capitalists, - as,

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1. See Whewell's Preface to the Literary Remains, p.xix
2. The comparative and historical framework of Hamilton's Progress of Society attracted Whewell's attention. Whewell Papers. Whewell to Jones, 26 Dec., 1830.
3. Richard Jones, Essay on Rent, p.xxix

> descending from the higher ranks, they approach the body of labourers by various gradations till they almost mingle with them - form a species of moral conductors, by which the habits and feelings of the upper and middling classes are communicated downwards, and act more or less powerfully upon those of the very lowest ranks of the community.'[1]

What Jones thus presented through this theory of history was a sense of the historical difference in modes of production. It was, as Marx argued, an analysis of the economic structure of society as revolving around the form of labour, that is, the form in which the labourer appropriated his means of subsistence.[2]

Even within particular modes of production, such as oriental despotism which occupied much of his attention, Jones was aware of great developmental differences between the various zones of Asian despotism.[3] Jones' cultural relativism also allowed him to take issue with the domination of 'exchange' in the classical model. He argued that there was no place in market oriented models for economic activities conducted within the framework of the self supporting household. Furthermore, growth in market participation was not an infallible index of improvement in the welfare of the peasantry.[4] The analytical strength of the Ricardian model was its abstraction - a dominant model with qualification. Jones' theory of rent and technical progress was not amenable to this formal quantitative relation between the institutional determination of rent and the course of agricultural change. There was no necessary connection between his classifications of economic systems and the actual mechanisms of economic growth. It was probably this that lay behind J. S. Mill's misunderstanding of the book. Mill apparently

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1. Richard Jones, Essay on Rent, pp.xxix and 233
2. Karl Marx, Theories of Surplus Value, Part III, pp.401 and 414. (Lawrence and Wishart edition), London, 1972.
3. This is a point made by Perry Anderson in Lineages of the Absolutist State, London, 1975, pp.484 - 489
4. See William Barber, British Economic Thought and India, 1600 - 1858, Oxford, 1975, p.201

saw it as 'a copious repertory of valuable facts'. Whewell was pained over Mill's failure to recognize the book's 'originality in point of view in which these facts are regarded and its philosophical classification'. He was enraged that Mill could speak so disparagingly of the book, and then adopt Jones' classification of rents, confusing ryot rents with metayage in the process. But the failure of Jones' ideas on rent and agricultural productivity to shake the orthodoxy were clearly illustrated by Mill's attitude:

> [Mill] 'holds that the proportional produce of land necessarily decreases with the extension of agriculture. How can we say [this], ... when we have to allow that there is a principle which we call the "progress of civilization", skill and the like, which may prevent this diminishing ratio for centuries, and during the whole life of a nation? I wish you could be here and we could discuss this book day by day, as we used to do with Malthus and Ricardo.'[1]

The Mechanism of Work

One significant result of Jones' historical approach and of his keen interest in the institutional and organizational aspects of economic systems was a novel social analysis of the sources of labour productivity. Jones developed a set of ideas on capital accumulation and technical change based on a reformulation of the Smithian division of labour. In apparent contrast to most of his contemporaries, he argued that the source of wealth was the earth and its elements. But the cause and instrument by which these natural powers could be developed and made fruitful was labour. The efficiency of labour contributed far more than any differences in the original sources of wealth. This efficiency was determined by the continuity of labour, skill, and power. This process was illustrated concretely in both agriculture and manufacturing. In agriculture, counselled Jones,

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1. Whewell to Jones, 30 April, 1848, in Isaac Todhunter, William Whewell, ii, 346

> 'Observe the skill, knowledge, and thoughtfulness by which the whole complex business of cultivation is conducted; ... well devised continuous industry aided by animal power, by manures, by implements and machines, supplies to the task of tillage a power far beyond what the mere manual labourer can command.'

And in manufacturing,

> 'the scattered artizans of other realms collected, here, into workshops and manufactories, the eye of a superior enforcing everywhere steady and continuous labour; knowledge and science imparting to human industry a sovereign power over the material world.'[1]

The key role given by Jones to the efficiency of labour based on continuity, skill, and power, was not, however, to subordinate the accumulation of capital to the division of labour. Quite the contrary,

> 'The formation of the human agency, by which the continuity of labour is secured; the maintenance of the intellect which enlightens its application; the employment of power which resides either in a higher order of moving forces or in mechanical contrivance, - ... are contributions of capital ... it is the same capital which makes the division of labour possible by maintaining the workmen in the progress of their task till markets - are found for their commodities.'[2]

He stressed that the division of labour was 'only one, and a subordinate, though important, effect of the accumulation of capital in production'.[3]

Jones discussed the ways in which continuity, skill, and power affected the productivity of labour, but argued that the condition for the existence of these factors was the growth of capital, especially fixed capital. Both continuity and skill relied on the creation of a separate class of workmen or supervisory capitalists. Jones saw continuity as best secured by 'contracts with workmen, superintended by vigilant taskmasters.' Skill implied creative organization and required the creation of a class 'freed from the necessity of mere manual labour', and 'at liberty to employ their intellect, to

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1. R. Jones, Literary Remains, p.12
2. ibid., p.32
3. ibid., p.33

facilitate the application of labour to its task'.[1] In agriculture this took place after the establishment of farmers' rents. The skill of the cultivating class increased as they were 'freed from the toilsome and absorbing occupations of the mere labourer, and not distracted by loftier pursuits and more enticing occupations.' The ultimate effect would be an increase in skill and 'an increase in the efficiency of capital employed in cultivation'.[2] In setting out the influence and growth of mechanical power, Jones made a very important distinction between force and the mode of applying that force, that is, machinery.

> 'whatever the moving force, ... we can have no measure of the power with which it is employed in production, unless we are familiar with the greater or less degree of perfection of the machinery and implements.'[3]

Jones argued that the 'enormous development' of 'aids to human power' had 'created a new era in the history of human industry'.[4]

The organization and efficiency of labour was integrated into Jones' more fundamental interest in the accumulation of 'auxiliary' capital. Essentially, auxiliary capital was to be distinguished from capital in general by its productivity. The distinction was basically that between 'capital deepening' and 'capital widening'. It was only the accumulation of auxiliary capital that implied an increase in total productivity. Defined in the Ricardian categories, this distinction was the difference between proportionate increases in fixed and circulating capital. Fixed capital, however, would be defined as including a technical multiplier. Jones analyzed a constant tendency to what we now call embodied technical change. The increase of auxiliary capital had the constant tendency to place more power (that is, 'moving force, and machinery') into agriculture.

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1. Jones, Literary Remains, pp.21 and 29
2. Jones, Essay on Rent, p.236
3. Jones, Literary Remains, p.25
4. Jones, ibid., p.10

> 'Where capital abounds, owners of it are always impelled by self interest to use the various additions which they employ, as much as possible, in the shape of auxiliary capital, and as little as they can help in the shape of the wages of labour ... The gradual increase of the relative quantity of auxiliary capital is, therefore, the ordinary effect of the progressive increase of the whole mass of capital employed in agriculture.'[1]

Improvements introduced with the increase of auxiliary power resulted in greater productivity and surplus profits, and thus increased the level of rents. The only possible factors counteracting this would be insufficient demand or declining fertility. Jones envisaged little possibility of either.[2] The social impact of this tendency to a rising proportion of auxiliary capital[3] would be a relative increase in numbers of the non-agricultural classes. With this would come a rise in the revenue and influence of the classes intermediate between landlords and manual labourers. The 'amount of the fund which forms the revenue of the intermediate classes' was of great importance 'to the political and social character of the people'.[4] But the direct employment impact of accumulation was also fundamental. The wages of labour had to be kept proportionate to the prosperity of capitalists. Capitalists could only have momentary advantage in the deprivation of labourers. The ultimate effect would be a drop in productivity, and a decline in the security of property.

> 'The accumulation of large masses of auxiliary capital cannot go on undisturbed in the midst of a degraded and turbulent population.'5

The technical form of this auxiliary capital was related to the endowments of particular countries. He argued that in England and France there had been recourse to 'the higher orders of moving force' to such an extent that

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1. Jones, Essay on Rent, p.241
2. ibid., pp.246 - 248
3. That is, the increasing organic composition of capital.
4. Richard Jones, Essay on Rent, p.233
5. ibid., p.291

differences of mechanical advantage did not have any great impact. In poor countries, however, it was not 'moving force' but basic implements, tools, and machinery which made a much greater contribution to efficiency.[1]

The tendency for the increasing accumulation of auxiliary capital was also a part of Jones' theory of technical progress. Jones changed the Ricardian theory of the composition of capital between its fixed and circulating components, by making auxiliary capital contingent on changes in knowledge. Fresh auxiliary capital had to be supplied in a new form and represented a progress of invention. Discoveries which added to 'moving force' were, however, differently spaced and developed than those which affected machinery.

> 'The discoveries of new moving forces are made rarely and at considerable intervals; the discovery of new modes of applying forces already known, by improved machinery and tools, is of daily occurrence, and facilitates the application of increasing masses of capital on a much more extensive scale, though in a less striking manner, ... than when such inventions as wind and water mills, or even steam were in the first instance applied.'[2]

This analysis of the structure of capital accumulation combined with the social impact of this accumulation led Jones and Cazenove, like contemporary critics in the 1830's, to make some suggestions on the sources of accumulation and the 'productive' attributes of the capitalist class. Jones argued that accumulation was dependent on the creation of a wage paying class. In the work of his colleague, Cazenove, the sources of accumulation were identified by means of psychological assumptions about savings habits. Though savings could be made from wages, this was unlikely because of the 'dissipated habits of the class to which it belongs.' The largest accumulations, he argued, came from profits. Those attributes of the capitalist class - care and

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1. R. Jones, Literary Remains, p.28
2. ibid., p.73

foresight in the management of capital, risks, and close occupation to business all encouraged savings habits.[1] Jones kept to a more tempered opinion of the sources of capital formation. He hoped that an egalitarian social structure would unleash formerly untapped sources of saving.[2]

The analysis of accumulation and the composition of capital led these critics, as it had most of their contemporary economists, into the debate on machinery and employment. Jones raised the issue of the inverse relationship between increases in employment and increases in the composition of capital, and argued that this impact on employment must act as a limit on the 'unchecked increase of auxiliary capital.'[3] Cazenove carried over the Malthusian view of this to argue that unless there was a simultaneous increase of demand, or a decline in wages and profits, the introduction of new machinery must make a certain amount of labour redundant. The application of machinery was beneficial to the community at large through the decline in the cost of production, and thus of price, but was not, in the first instance favourable to the demand for labour.

> 'The revenue which is saved or liberated by ... the fall of price, is never adequate to the employment of the whole quantity of labour, which is displaced, at the same rate of wages or profits. ... but in remoter and more permanent consequences it is favourable to the demand for labour. The cheapness extends the market so that the whole value produced increased, and this new revenue forms an additional fund for the maintenance of labour.'[4]

Jones' broad sweep of history drew explicit attention to the social and institutional aspects of technical change. His friend Babbage developed the impact of economic organization on a more microscopic but immediately relevant level in his work on the structure of the factory. Babbage had

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1. John Cazenove, Outlines of Political Economy, p.96
2. R. Jones, Literary Remains, pp.39 - 47 and 231 - 232
3. R. Jones, Essay on Rent, p.291
4. John Cazenove, Outlines of Political Economy, p.117

quite close connections with Jones, and was a member of Whewell's intellectual circles. His book on the factory, however, also had very close connections with the current concerns of industrial managers. The next chapter will investigate the immediate connections between this world of the intellectual criticism and the industrial world, through the medium of Charles Babbage.

CHAPTER SIX

Machinery on the Ground: The Domestic Economy of the Factory

Charles Babbage, though nurtured in the intellectual circles of Cambridge, was the most accessible writer to carry the machinery issue to the ground level. The context for Babbage's work, particularly his On the Economy of Machinery and Manufactures should be sought neither in the world of science, nor in the world of higher theoretical debate in political economy. Both Babbage, then Andrew Ure stressed observation as the source of their studies. Babbage's book was, in an indirect way, a result of his scientific interests, particularly his obsession with his 'calculating machine'. But more fundamentally, it was the result of observations of years visiting 'workshops and factories, both in England and on the Continent, for the purpose of endeavouring to make myself acquainted with the various resources of mechanical art'.[1] Similarly for Ure, though he had taught at the Andersonian Institute and was a scientific consultant, he stressed the non-academic sources of his book, The Philosophy of Manufactures. It was 'derived from a summer wandering through the factory districts of Lancashire, Cheshire and Derbyshire.'[2]

The context for both Babbage's book and Ure's should be sought in the theory and practice of the early industrialists, and in the new undergrowth of technological literature. Ample contextual literature exists in the 'Histories' of McCulloch, Baines, Kennedy and Farey, the technical encyclopaedias like Peter Barlow's edition of the Encyclopaedia Metropolitana, the commercial and technological dictionaries such as those written later

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1. Charles Babbage, On the Economy of Machinery and Manufactures, (fourth edition), London, 1835, p.iii
2. Andrew Ure, The Philosophy of Manufactures, London, 1835, p.ix

by Ure and McCulloch, and the technical journals.[1] 'The factory' had become a topic of popular literature. The array of published work reflected this new market.

An equally important context was the working class response, something which certainly dictated the tenor of much of Ure's work. The critical response of many working class theorists and trade unionists stimulated enthusiastic justifications, by middle class groups and their representatives, of the system of industrialization as it was.

One finds, in the writings of industrialists and popularizers, the wide range of contemporary ideas on the domestic economy of the factory. Babbage's book was very much a part of contemporary discussion, and it contributed to ongoing studies of the organization of work in the years following. I will make use of this popular and practical literature as the suitable background for Babbage's ideas.

Workshop Organization

Babbage's On the Economy of Machinery and Manufactures first came out in 1832 with the object of presenting the reader with the mechanical principles of arts and manufactures,

> 'which struck me as the most important, either for understanding the actions of machines, or for enabling

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1. For example see J. R. McCulloch, 'On the Rise, Progress, Present State and Prospects of the British Cotton Manufacture', Edinburgh Review, June, 1827; John Kennedy, 'Observations on the Rise, Progress of the Cotton Trade in Great Britain', 1815, Memoirs of the Manchester Literary and Philosophical Society, (2nd series), iii, 1829; Edward Baines, History of the Cotton Manufactures in Great Britain, London, 1835; Peter Barlow, A Treatise on the Manufactures and Machinery of Great Britain to which is prefixed an Introductory View of the Principles of Manufactures by Charles Babbage, London, 1836; John Farey, A Treatise on the Steam Engine, Historical, Practical and Descriptive, London, 1827; C. F. Partington, Account of Steam Engines and Other Models of Machinery, Illustrative of the Latest Improvements in Railroads, Steam Navigation, and the Arts and Manufactures, with an Historical and Descriptive Account of the Steam Engine, London, 1840; Andrew Ure, A Dictionary of Arts, Manufactures and Mines, London, 1839.

> the memory to classify and arrange the facts connected with their employment.'1

As stated before, Babbage collected most of his information on visits through the factory districts of Britain and the continent. In the first edition, he both exempted himself from taking up specific questions of political economy, and criticized political economists generally as 'closet philosophers' 'too little acquainted with the admirable arrangements of the factory'.[2] He specified that he had not 'attempted to examine all the difficult questions of political economy which are intimately connected with such enquiries'.[3] His second edition of November 1832, however, was an attempt to correct this. He added three new chapters - one on 'The New System of Manufacturing', proposing a piece rate wage system, another 'On the Effects of Machinery in Reducing the Demand for Labour', and one 'On Money as a Medium of Exchange'.[4]

In many ways,too, the book was an ingenious offshoot of Babbage's work on the calculating engine. As he pointed out himself in his first preface, the book was an application of the principles of the calculating engine, bringing to bear the mathematical precision and predictability of his machine on the factories he had toured.[5] The underlying interdependence in the engineering industry between the machine product and the technical process was completely explicit in Babbage's work. Babbage's vivid application to the factory of 'these principles of generalization to which his other pursuits have naturally given rise' quite likely had an important precedent

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1. Charles Babbage, Machinery and Manufactures, (Preface to first edition), pp.iii - iv
2. Charles Babbage, Machinery and Manufactures, p.156
3. ibid., (Preface to first edition), p.iv
4. ibid., p.viii. This may have been in response to McCulloch's criticism, 'Babbage on Machinery and Manufactures', Edinburgh Review, January, 1833. It is possible Babbage heard these criticisms soon after his first edition appeared.
5. Babbage, Machinery and Manufactures, p.iii

and possible influence in the similar attributes of the engineering workshop or factory. The influence of the calculating engine was noticed by his readers. Cobbett's Magazine for instance, wrote

> 'The work bears the traces of the correctness of this account of its origins'. It 'is the emanation of a mind habituated to mathematical precision and arrangement', and 'directed to a subject not previously treated with such exactness.'[1]

But the connections between the book and the situation in the engineering industry were more than mere parallels. The engineer who was trying to build Babbage's machine was John Clement, a Maudslay pupil. Furthermore, Clement's bills were put to a Commission of the Royal Society made up of Donkin, Rennie, Brunel and Maudslay.[2] Even if the actual influence of the work process in the engineering industry may have been a very indirect one in Babbage's mind, the implicit context was certainly plain.

Babbage's overriding concern was with what he called 'the domestic economy of the factory'. He argued that if the maker of an article wished to become a manufacturer he had to pay attention to principles other than merely mechanical ones. He had to attend to the principles of domestic economy, and arrange the whole system of his factory in such a way as to sell articles at the minimum possible price.[3] This domestic economy was to be achieved in the first instance by attention to scale.

> 'When the number of processes into which it is most advantageous to divide it, and the number of individuals to be employed in it, are ascertained, then all factories which do not employ a direct multiple of this latter number, will produce the article at a greater cost.'[4]

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1. 'Mr. Babbage and the Useful Arts', Cobbett's Magazine, December, 1833, ii, No.11, p.383
2. W. H. G. Armytage, A Social History of Engineering, London, 1961, p.128
3. Babbage, Machinery and Manufactures, p.203
4. ibid., p.212

Babbage's attention to size was a frequently voiced concern among industrialists. William Fairbairn connected scale with techniques. 'The improvements in tools changed the mode of doing mechanical work, by rendering necessary large and carefully laid out manufacturies'. Watt's steam engine had created such stringent requirements in tools and organization that the large factory came to replace the small millwright's shop.[1] Furthermore, Watt's patent, it was believed, had brought internal economies of scale with its prolonged period of monopoly.

> 'for by concentrating the business in their hands, they always had orders for a sufficient number of engines of the same kind, to enable them to arrange their manufactory upon system, with a great division of labour, whereby all their workmen acquired dexterity from continual repetition of the same work, and the work was better executed, at a less expense than if they had made fewer engines'.[2]

Large factories, however, generally bring out problems of communication between departments. The communication innovations noticed by Dodd were earlier recognized by Babbage, who also traced out some very farseeing implications. In discussing the economy of time through the introduction of machinery, Babbage noted the use of tin tubes for speaking through, used in London shops and trades.[3] It was in a bookbinder's years later that Dodd noticed

> 'one of those simple but valuable expedients for saving time, now so much employed in large factories, - we mean a series of "speaking tubes" ... which passes to "the offices of all the foremen above and below stairs".'[4]

It was in his discussion of the Times as a large establishment applying an extensive mental and bodily division of labour, that Babbage noticed the

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1. W. Pole, ed., The Life of Sir William Fairbairn, London, 1877, p.47
2. J. Farey, A Treatise on the Steam Engine, London, 1827, p.647
3. Charles Babbage, Machinery and Manufactures, p.9
4. George Dodd, Days at the Factories, or the Manufacturing Industry of Great Britain Described, London, 1843, p.364

possibilities arising from a system of wires and pullies for transmitting things. He proposed the use of stretched wire for a 'species of telegraphic communication'.[1] Ten years later, Dodd, in his Days at the Factory found in a copper and lead factory 'an ingenious railroad fixed near the ceiling or roof, whereby boilers, coppers, stills, and engines etc. were suspended from a wheeled carriage.[2] These early perceptions of the development and uses for the telephone, telegraph, and the overhead assembly track were generated by the contemporary concern for 'organization in the works'.

Similarly, as others of his contemporaries had noticed, the scale of a factory was also related to the division of labour.

> 'We have seen that the application of the Division of Labour tends to produce cheaper articles; that it thus increases the demand; and gradually, by the effect of competition, or by the hope of increased gain, that it causes large capitals to be embarked in extensive factories'.[3]

The implication to be drawn from this interdependence of scale and the division of labour was that throughout every stage of manufacture in such a factory, the same economy of skill prevailed.[4]

Babbage's domestic economy of the factory was fundamentally based on the Smithian division of labour. He reiterated those effects of the division of labour analyzed by Smith, but added to this what became known as the 'Babbage principle'.

> 'That the master manufacturer by dividing the work to be executed into different processes, each requiring different degrees of skill or of force, can purchase exactly that precise quantity of both which is necessary for each process; whereas if the whole work were executed by one workman, that person must possess sufficient skill to perform the most difficult, and sufficient strength to execute the most laborious, of the operations into which

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1. Charles Babbage, Machinery and Manufactures, p.275
2. George Dodd, Days at the Factories, p.517
3. Charles Babbage, Machinery and Manufactures, p.216
4. ibid., p.217

the art is divided.'1

Long before Babbage outlined his famous principle, Boulton and Watt had implemented a policy of division of labour and skill distribution in their Soho foundry. They left behind two papers describing the details of this policy. The first papers, 'Specifications of the Fittings of the Engine Materials and the Shops where it is to be Done', gave a complete list of the constituent parts of the steam engine with all its subdivisions. It set out in detail all the operations to be performed on each article in its proper sequence. This paper was followed by 'Arrangements of Workmen and Distribution of Work at Soho,' which indicated extensive division of labour and careful job specification. It contained detailed lists of jobs assigned to each workman throughout the factory. As Roll has pointed out, the papers show that at Soho, the production processes for each part had 'been broken up into a long series of various minor operations, showing a very high degree of the application of division of labour to factory routine.'2

This division of labour also applied to the use of machinery. According to Babbage there were two types of machine: that which produced power, and that which transmitted force and executed work. Machines which transmitted force added to human power. It was here that Babbage used the very farseeing example of the use of rollers and grease for reducing friction.3 Babbage's classification of machinery prompted McCulloch to develop another point unexplored in this respect by Babbage. McCulloch argued that the major reason for the introduction of machinery was efficiency. But to establish this efficiency some idea of durability was necessary. McCulloch defined

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1. Babbage, Machinery and Manufactures, p.175
2. Eric Roll, An Early Experiment in Industrial Organization, London, 1930, pp.178-181
3. Babbage, Machinery and Manufactures, p.8

durability as dependent not only on construction materials, skill displayed in its construction, and the care taken in repairs, but also on the small areas and low velocity of the moving parts.[1]

But this question of durability was taken up by Babbage in other areas. He stressed the importance not so much of velocity in the running of machinery as of regularity, that is 'the uniformity and steadiness with which machinery works'. Examples of this were the governor of a steam engine and the regularity in supplying fuel to the fires of boilers. Uniform action in both cases led to greater 'duration' by economizing on coal consumption.[2]

Velocity was taken up in Babbage's very sophisticated discussion of time and motion. Here he argued that fatigue was not dependent on force, but on the frequency with which that force was exerted. There were two parts to any exertion; first, the expenditure of the force necessary to drive the tool or instrument, and secondly, the effort required for the motion of some limb of animal or man producing the action. In order to economize on labour, it was necessary to adjust the weight of that part of the body which was moved, the weight of the tool it urged, and the frequency of repetition of these efforts so as to produce the greatest effect.[3] Again, the industrialists had anticipated much of what Babbage had to say.

William Brown, the flax spinner, had views on the role of management and improvement which give high accord to the work process. As he wrote,

> 'The first and great object to be aimed at by the Manager of East Mill is PROFIT. The chief requisites to profit are: a good quality of yarn - large quantity, little waste - moderate expenses - and a good state of the

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1. /J. R. McCulloch/, 'Babbage on Machinery', pp.319 - 320
2. Babbage, Machinery and Manufactures, p.28
3. ibid., p.31

machinery'.[1]

To secure this in the case of his mill, he thought it necessary that the business be laid out in twelve different departments each of which required its own separate portion of attendances and consideration.[2] These priorities in management were reflected in his attitude to improvements:

> 'every mill manager [should] devote a portion of his time to the cultivation of improvements. Should this be neglected the consequences must be disagreeable as one must be left behind his neighbours. Improvements may be made in two ways; either by invention or adoption. If invention is to be tried, the best way of proceeding is to understand the present machinery well, to be familiar with its imperfections, and to remedy them accordingly. If adopting is to be tried, the only way is to visit improved mills, to acquaint oneself with the nature of their improvements, and to adopt accordingly ... One thing, however, I require to keep in mind, and that is - that the success of a mill depends much more upon keeping the machinery in good order and managing well on the present plan, than on pursuing and looking after what are commonly called alterations and improvements'.[3]

The successful entrepreneur had a broad knowledge of new techniques, and thought carefully of their application to his particular use, thus taking up all those questions of technical interrelatedness, layout, power sources, and costing. John Marshall, the Leeds flax spinner was one such example. Throughout the 1820's, he visited not only flax mills, but leading cotton and woollen mills to observe new techniques and enquire into adapting them to the linen industry. He kept special notebooks on processes throughout this period.[4] In a 'General Notebook' kept between 1790 and 1830, he kept the names of a number of specialized machine makers, information on sizes and

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1. Chapman, 'William Brown of Dundee 1791 - 1864: Management in a Scottish Flax Mill', Explorations in Entrepreneurial History, 1952, 124
2. ibid., p.124
3. William Brown, 'Manuscript Essays', cited in Chapman, p.126
4. Brotherton Library, Leeds University, (Marshall Papers), Salop Notebooks on Processes, 1826 - 1829 and 1829 to 1835, Ms.200, No.36 and 37

types of textile machinery, calculations of the power required to work various types of machinery, and details of steam engine types including information on coal consumed, power, strokes per minute and the diameters of each. The Notebook also included the opinions of several other proprietors and engineers on the best ways of increasing the speed of machinery as well as information on the employment of children and the hours worked at various cotton mills.[1]

Labour Time and Motion

An interesting counterpart to the discussion of the domestic economy of the factory was provided by Owen's application of management principles to the care and order of the living machines. Owen put across his philanthropic personnel policy in mechanical terms to his audience of manufacturers. He compared the up to date treatment of machinery with the treatment of labour. He argued that successful manufacturers knew the advantages of 'a substantial, well contrived and well executed machinery.' but they had an equal interest in the good arrangement of their labour.

> 'The more delicate, complex living mechanism would be equally improved by being trained to strength and activity; and that it would also prove true economy to keep it neat and clean; to treat it with kindness, that its mental movements might not experience too much irritating friction; to endeavour by every means to make it more perfect; to supply it regularly with a sufficient quantity of wholesome food and other necessaries of life, that the body might be preserved in good working condition, and prevented from being out of repair, or falling prematurely to decay.'[2]

Babbage, in contrast to Owen, believed that the insufficiencies of the living machinery' could be supplied by machines. Like many of his contemporaries, he identified the great advantage of machinery with the check it provided against the inattention, idleness and dishonesty of human

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. The Marshall Papers, General Notebook, 1790 - 1830, Ms.200
. Robert Owen, 'Address to the Superintendents of Manufactures', in A New View of Society, in V. A. C. Gattrell, ed. Robert Owen, p.96

agents. The regularity it allowed contributed to precision and predictability. Such machinery introduced the possibility of precise measurement, and Babbage indulged himself in proposing instruments for counting the number of steps made, the distance travelled, the number of strokes made by a steam engine. This fascination with precision had its parallels in the interests of the industrialists.

Good order in a textile mill as in an engineering plant was connected to precision and measurement. Both Brown and Montgomery were completely uncompromising as to the role of calculation in good management. Montgomery noted that those in charge of spinning factories as well as all young carding and spinning masters were required to make calculations quickly.

> 'It is a most essential qualification on the part of the manager that he be expert in performing all kinds of calculations connected with the business; the advantages of which will be apparent in various respects. First in regulating the speed of the different machines; second, in adjusting the draughts of the various machines; and third, in making changes in the qualities of the cotton and sizes of the yarn'.[1]

He also included several model calculation problems on such questions as the cost of yarn and the size of roving.

Measurement was a part of discipline and William Brown directed his under-manager thus:

> 'a desk to be placed in the reeling room and a new book begun for keeping the accounts of the spinners and reelers work and waste, the weight of the yarn, the quantity spun etc. The overseer with your assistance will daily attend to it and it will be highly beneficial for you to spend a portion of time with it every day, examining and considering the state of the different hands' work and waste, comparing the one with the other, yesterday's with today's, and making yourself intimately acquainted with all their performances'.[2]

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1. James Montgomery, The Theory and Practice of Cotton Spinning; or the Carding and Spinning Master's Assistant, (second edition), Glasgow, 1833, p.243
2. 'William Brown's Notebooks', pp.128 - 132

Dodd noticed a similar concern with precise accounting in some of the factories he visited. In a copper and lead factory he found great care and completeness in measurement 'necessary for the complicated operations of the factory'.

> 'The mode in which every hour of every man's time has been employed is strictly ascertained, in connection with the symbols attached to the respective orders; the "time" of each workman is so ascertained and recorded that an error can hardly occur'.[1]

As a follow up to this interest in measurement, Babbage devised a questionnaire to aid those investigating factories in the same manner as he had done. The questionnaire, a form of time and motion study, included questions on the possible processes for producing an article, possible defects, waste allowed, weight of the product compared to its raw material, provision and repair of tools by masters or men, cost and wear and tear of all machinery, and the number of processes together with the exact number employed in each process.[2] A separate questionnaire was to be provided for each process, and was to include information on: the type of machine used, the number of operatives attending it, together with their age and sex, the pay and hours of each, the provision of tools, skill required, the number of times each operation was repeated, and the system of payment.[3] Babbage even included warnings on the verification of all statements made, and experimental methods of observing work.

Babbage's account of the impact of the division of labour on skill levels and labour displacement was conventional. He did recognize transitional problems due to labour immobility, and was suitably ambivalent on the question

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1. George Dodd, Days at the Factories, Or the Manufacturing Industry of Great Britain Described, p.548. This precision seems to have been in marked contrast to the primitive accounting methods in use at the time. See S. Pollard, 'Accounting and Management', Genesis of Modern Management, Harmondsworth, 1965, Chapter 6; and G. A. Lee, 'The Concept of Profit in British Accounting 1760 - 1900', Business History Review, Spring, 1975.
2. Babbage, Machinery and Manufactures, pp.115 - 116
3. ibid., p.117

of skill. The power loom, for example, required less strength and skill than the handloom, but this was not to say the industry as a whole showed a tendency to degrading skill. New skills were called into action in building factories, making steam engines and machinery, in devising improvements in the structure of looms, and finally in regulating the whole economy of the factory. Such work, 'calls in labour of a higher order than that superseded'.[1] Babbage's explication of his 'New System of Manufacture' was similarly a very conventional presentation of incentive payments and piece rates.[2]

The Control of Skill

Just how conventional this presentation was can be ascertained by looking at some of the work of contemporary popular writers.[3] There was considerable overlap between the interests of industrialists like William Brown and James Montgomery, and popular writers on the textile industry such as McCulloch, Baines, and Kennedy. This overlap was particularly evident in discussions of the division of labour and skill. Montgomery in fact quoted McCulloch on the significance of the division of labour in the factory.

> 'Our establishments for spinning, weaving, printing, bleaching, etc. are infinitely more complete and perfect, than any that exist elsewhere: the division of labour in them is carried to an incomparably greater extent, the workmen are trained from infancy to industrious habits, and have attained their peculiar dexterity and sleight of hand in the perfection of their separate tasks, that can only be acquired by long and unremitting application to the same employment ...'4

Britain's international superiority depended on this division of labour. In other countries,

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1. Babbage, Machinery and Manufactures, p.339
2. Babbage, ibid., pp.250 - 259, and 295
   The New Moral World foresaw little advantage to the workers in the scheme while employment was 'determined by a fluctuating commercial rivalry'. The New Moral World, 8 April, 1836.
3. See, for example, 'William Brown's Notebooks', p.133
4. James Montgomery, Theory and Practice of Cotton Spinning, p.287

> 'Their establishments cannot at first be sufficiently large to enable the division of employments to be carried to any considerable extent; at the same time that expertness in manipulation and in the details of the various processes, can only be attained by slow degrees'.[1]

The role of the division of labour in actual technical improvement in the cotton industry had been singled out some years before in an influential essay by John Kennedy. He constructed a pseudo history of the cotton industry around the principle of the division of labour. Kennedy argued that the division of labour led to small improvements made by workers in a series of hand implements. This continued until their cottages filled with machinery and they were 'forced out of their dwellings by the multiplication of their implements'. It was at this point that the factory system started, as well as the division of one branch of the trade into two distinct parts - carding and spinning. There were subsequent improvements in carding and in the spinning jenny. It was in following up these important improvements that manufacturers found rotary motion could be applied to all the new machines.[2]

As in the engineering industry, so in the textile industry, skill and control were the logical corollaries of the division of labour. Kennedy found the source of skill in his factory system. The use of water power, on his telling, had forced the removal of manufacturers from urban centres. This resulted in difficulty in procuring or repairing machinery. This led to a new demand for a 'higher class of mechanics ... watch and clockmakers, white-smiths, and mathematical instrument-makers'.[3] But the skill required to produce the machines also brought the displacement of skills of the supposedly lower class of labourers who worked on the machines. But Baines

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1. James Montgomery, The Theory and Practice of Cotton Spinning, p.288
2. John Kennedy, 'Observations on the Rise and Progress of the Cotton Trade in Great Britain', Memoirs of the Manchester Literary and Philosophical Society, 2nd series, iii, 1819, pp.118 and 121
3. John Kennedy, 'Observations on the Cotton Trade', p.124

saw this in a more positive light. It was the steam engine, not the workman which had become the drudge.

> 'as to their motions "rivalling the mathematical precision, the incessant motion, and the exhaustless power of the machine", nothing can be more mistaken. It is the very reverse of the fact. All the precision, power and incessant motion belong to the machines alone; and the work-people have merely to supply them with work, to oil their joints, adjust their slight inaccuracies, and piece the threads broken by the mechanical spinner'.[1]

As Baines saw clearly, all of this brought greater control to the master manufacturer. He recognized that carrying out a number of operations in the same building allowed the master spinner to superintend every stage of manufacture. It gave him greater security, saved time, prevented the inconvenience of having one class of manufacture fail to complete its part, and allowed mechanics to be employed on the spot over a large number of machines.[2] It was machinery itself that brought even greater control. 'This country excels every other in the making of machines and in the means of working them advantageously, and besides this for the reason just mentioned, our manufacturers are interested in having their goods produced as much as possible by machinery'. This reason was control. The machine, Baines argued, caused the price of goods to be regulated more according to the profits of capital than to the wages of labour.[3] This principle applied just as forcefully to the machine making industry. Fairbairn admitted that with the advent of the new large engineering factories

> 'the designing and direction of the work passed away from the hands of the workman into those of the master and his office assistants. This led also to a division of labour; men of general knowledge were only exceptionally required as foremen or outdoor superintendents: and the artificers became, in process of time, little more than attendants on the machine'.[4]

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1. Edward Baines, History of the Cotton Manufacture in Great Britain, London, 1835, p.460
2. ibid., p.185
3. ibid., p.507
4. W. Pole, Life of William Fairbairn, p.47

Control was also the concern in labour discipline. William Brown made this a particular concern, and attached great importance to a 'set of good hands'. He advised liberal wages for the spinners, and moderate wages consistent with the state of trade for other workers. Disciplined attention to their duty and good habits were absolutely necessary attributes of his employees.[1] Marshall's mill evoked his praise for the iron discipline among employees in the works.[2] In his passages on the exercise of authority he stressed incentive. 'Masters reap great benefit from having the art of making their servants interested in their work'.[3]

The commonest incentive over the period was the piece rate. Brown followed conventions on this. The application of the piece rate system had, however, been developed to a high sophistication in the engineering industry in the last years of the Eighteenth Century. Boulton and Watt devised very complicated combinations of time and piece rates with bonus payments years earlier than Brown gave his advice. Another incentive was the delegation of authority. Sub-contracting various jobs within the works had long been practised.

The Scientific Technocrat

The most strikingly novel ideas in On the Economy of Machinery and Manufactures were not those on the 'order of the factory', but on the implications of the growing interdependence of science and technology. The division of labour was also applied to mental production.

> 'the efforts for the improvement of its manufactures which any country can make with the greatest probability of success, must arise from the combined exertions of all those most skilled in the theory, as well as in the practice of the arts; each labouring in that department for which his natural capacity and acquired habits have rendered him most fit'.[4]

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1. William Brown, 'Manuscript Essays', in Chapman, p.128
2. ibid., p.132
3. ibid., p.132
4. Babbage, Machinery and Manufactures, p.379

This division of labour was evident too within the world of science itself. The cultivation of botany for example came to require greater specialization than could be provided by the comprehensive Royal Society. The Linnaean Society was the result, and this was soon followed by the Geological and Astronomical Societies.[1] These more specialized societies led to greater knowledge of the chemical and physical properties of bodies, and promoted interest in less tangible areas like light, electricity and heat. But the ultimate result of the mental division of labour was an even higher science - Babbage's 'science of calculation'. This science, even more so than the others would be intimately connected with technology. It

> 'becomes continually more necessary at each step of our progress and which must ultimately govern the whole of the applications of science to the arts of life'.2

This vision of science and technology went beyond even Andrew Ure's wondrous automatic factory. Babbage's calculator, 'based on the method of differences' brought a vision of a computer run technology. But Andrew Ure's automatic factory would be a stage along the way. Senior's description, over ten years later, of modern industry in terms of physical forces was matched by these remarkable 'ground level' predictions of automation and computer based technology.

Ure saw his work as a definite advance on Babbage's and attached greater credibility to his own authority. Cardwell has described Ure's Philosophy of Manufactures as a fairly obvious imitation of Babbage with some insight into the automatic factory.[3] But, in fact, Ure took pains to distinguish himself from Babbage. He rejected the principle of the division of labour as the significant feature of the factory, and alluded to Babbage by implication

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1. Charles Babbage, Reflections on the Decline of Science in England, London, 1830, pp.40 - 43
2. Babbage, Machinery and Manufactures, p.388
3. D. S. L. Cardwell, The Organization of Science in England, London, 1957, (revised edition 1972) p.39

when he argued that the 'scholastic dogma of the division of labour into degrees of skill has been exploded by our enlightened manufacturers'.

> They are - 'better acquainted with the general economy of the arts, and better qualified to analyze them into their real principles, than the recluse academician can possibly be, who from a few obsolete data, traces out imaginary results, or conjures up difficulties seldom encountered in practice'.[1]

Ure saw himself as eminently more qualified than Babbage on this issue. He had taught at the Andersonian Institute for many years, and when the city of Glasgow decided to create a monument to Watt, he was asked to give the public lecture on the steam engine.[2] In 1830 he had moved to London, and set up in private practice as a consultant in science. In this guise, he visited professionally most of the new Midland industrial areas and some in Belgium and France. He advised mainly on technical improvements in the cotton industry, bleaching and dyeing processes, glass manufacture, and mining.[3] This is corroborated in the Preface to his Dictionary of Arts, Manufacture and Mines, where Ure says he was consulted professionally by the proprietors of factories, workshops and mines here and abroad. The stores of information collected in the process were used in his Dictionary. His consultancy fees, standardized over the period, indicate a very diverse and formally constituted consultancy practice, and Copeman even found a

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1. Andrew Ure, The Philosophy of Manufactures, London, 1835, pp.23 - 24
2. W. S. C. Copeman, 'Andrew Ure', Proceedings of the Royal Society of Medicine, 1951, pp.658 and 661
3. A. Ure, A Dictionary of Arts, Manufactures and Mines, London, 1839, pp.iv - v

scientific salon' attached to him in 1835.[1]

The purpose of his book, The Philosophy of Manufactures, based on this experience, was purely pedagogical.

> 'Were the principles of the manufactures exactly analyzed, and expounded in a simple manner, they would diffuse a steady light to conduct the masters, managers, and operatives, in the straight paths of improvements, and prevent them from pursuing such dangerous phantoms as flit along in the monthly patent-lists'.[2]

Ure's factory was a much more restricted one than Babbage's. The factory was defined as the combined operation of many orders of labourers attending a system of productive machines continuously impelled by a central power. Under this definition, any mechanism that did not form a connected series of operations was excluded, such as iron works, dye works, and brass foundries. McCulloch found such a narrow definition applicable only to textile mills, and it totally ignored the all important machine making

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1. W. S. C. Copeman, 'Andrew Ure', 'Fees or Charges for Chemical Analysis or for business relative to the application of Science to the Arts and Manufactures', p.661

Consultation	Fee
Written opinion on a short case or letter of inquiry	£2.2.0
For a series of chemical experiments per day	£5.5.0
Attendance in London to view any manufactury; to examine apparatus or inspect any chemical process	£4.4.0
For similar attendance which shall occupy the whole or chief part of the day	£6.6.0
Attendance at a distance from London exclusive of travelling expenses per day	£7.7.0

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2. A. Ure, The Philosophy of Manufactures, p.viii

sector.[1] However, in Andrew Ure's mind, the factory had taken on distinctly mystical qualities.

> 'The idea of a vast automatum, composed of various mechanical and intellectual organs, acting in uninterrupted concert for the production of a common object, all of them being subordinated to a self regulated moving force'.[2]

In Ure's factory the division of labour was a thing of the past.

> 'wherever a process requires peculiar dexterity and steadiness of hand, it is withdrawn as soon as possible from the cunning workman, who is prone to irregularities of many kinds, and it is placed in charge of a peculiar mechanism, so self regulating, that a child may superintend it ... on the automatic plan, skilled labour gets progressively superseded, and will eventually, be replaced by mere overlookers of machines'.[3]

Ure was more than ordinarily paranoid about the skilled worker. In his view, the more skilled the worker, the more 'self willed and intractable' he became, 'the less fit a component of a mechanical system, in which, by occasional irregularities, he may do great damage to the whole.[4] Ure's 'philosophy of manufactures' was an exposition of the general principles by which industry could be conducted by self acting machines.[5] This perfection of automatic industry was to be found in a modern cotton mill. But Ure also drew attention to the machine factory which displayed the division of labour in many gradations. However, the dexterous and skilled labour of filer and driller had been superseded by planing, key grove cutting and drilling machines. The self acting slide lathe had taken the place of iron and brass turners.[6]

Ure's ideas on self acting machinery found their greatest application in the new power machinery of the cotton industry. His Philosophy of

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1. J. R. McCulloch, 'Philosophy of Manufactures', Edinburgh Review, 61, July, 1835, p.454
2. A. Ure, Philosophy of Manufactures, p.13
3. ibid., pp.19 and 20
4. ibid., p.20
5. ibid., pp.1 - 2
6. ibid., p.21

Manufactures was thus logically completed in his empirical study, The Cotton Manufactures of Great Britain. He was most impressed with the self acting mule and the power loom. This new mechanical union would put an end to the folly of trade unions and secure a monopoly of coarse cotton fabrics to Great Britain.[1] The powerloom in contrast to the handloom represented the first principle of all mechanism impelled by steam and water power, that is continuity of action. On the other hand, the characteristic of human labour was alternate effort and repose. Furthermore, the interruption in the movement of the shuttle which took place while the weaver was dressing a portion of the work served mainly to diversify his labour. Such diversity would be intolerable in the automatic factory where power and time had to be economized to the utmost.[2]

Moreover, the self actor of Sharpe, Roberts and Co. not only defused the effect of trade union action, but had actually been invented on the impulse of the 'injurious effects resulting from turnouts, and other acts of insubordination on the part of the work-people'.[3] This at least was one part of Ure's book that impressed McCulloch. It allowed him to give even greater emphasis to the 'evil effects of combinations', and to the identity of interests of workers and their employers.[4]

Just as his contemporaries had given thought to the layout and design of the factory, so Ure repeated this counsel and gave high praise to William Fairbairn. His automatic factory could be built in the age of factory architecture. In his view there was presently little awareness of how much the different orders of machines depended for the production and precision of their performance on the right magnitudes, proportions

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1. A. Ure, The Philosophy of Manufactures, p.331
2. A. Ure, The Cotton Manufacture of Great Britain, London, 1836, ii, p.287
3. ibid., p.194
4. J. R. McCulloch, 'Philosophy of Manufactures,' p.470

and adjustments of the mainshafting and wheel gearing. But something like Fairbairn's factory architect business offered a complete package deal to the manufacturer. The capitalist had only to state the extent of his resources, the nature of his manufacture, and his intended site and coal or water facilities, and he would be furnished with complete 'designs and estimates on economical terms'.[1]

If Babbage's workshop found its closest image in the calculating machine, Ure's automatic factory was the image of war. Ure several times alluded to the parallel. His preface spoke of the 'bloodless but still formidable strife of trade'.[2] He described the introduction of the self acting mule in terms of the classical battlefield and the destruction of union militancy.

> 'Thus the Iron Man, as the operatives fitly call it, sprung out of the hands of our modern Prometheus at the bidding of Minerva - a creation destined to restore order among the industrious classes, and to confirm to Great Britain the empire of art. The news of this Herculean prodigy spread dismay through the Union, and even long before it left its cradle so to speak, it strangled the Hydra of misrule'.[3]

It seems likely that the social spin offs of the production process were pervasive. Samuel Bentham was a specialist in organized production techniques and he himself had devised the assembly line production of ships biscuits at the victualling office, Deptford. He was also responsible for Maudslay's and Brunel's production layout.[4] The Benthamite 'Panopticon' devised by Jeremy Bentham with the assistance of his brother Samuel, shows the real integration of utilitarian philosophy with technology. Most of the utilitarian educational schemes were also structured on the basis of mass production, assembly line techniques as first devised in the factory. The

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1. A. Ure, Philosophy of Manufactures, p.33
2. ibid., p.vii
3. ibid., p.367
4. W. Armytage, A Social History of Engineering, p.117

factory, in turn, however, found its most sympathetic analogue in war.

I have outlined here to what extent the ingenious insights of Babbage and Ure written in the early days of the factory system very much reflected contemporary opinion and vision. The very popularity of their work attests to this conclusion. The interconnections between technology and the organization of production was a familiar theme in the popular work on technology throughout this period. This popular literature had become a definite part of middle class culture, and the interests and assumptions lying behind this literature helped to form the objectives and world view of the middle class scientific and statistical societies formed during the 1820's and 1830's. Writers such as Babbage, Ure, Baines, and Kennedy acted as conductors between the intellectual circles of political economy and the provincial elites of industry. These elites formed their own societies to focus local attention on social and economic progress. Industrialization became the doctrine in societies to promote working class education, practical science and social reform.

CHAPTER SEVEN

The Social Image of Machinery

Many of the political economists I have looked at in preceding chapters drew the evidence and, in some cases, the stimulus for their ideas on technology, skill and capital from the popular technological literature of their day, and from policy debates. Popular works such as those of Charles Babbage and Andrew Ure, depicting a fascination with the factory, crossed the boundary between the world of the manufacturer and the intellectual concerns of the political economist. Babbage's Economy of Machinery and Manufactures and most of Ure's work belonged, we have seen, to an extensive underworld of industrial histories, lives of inventors, technological dictionaries, and encyclopaedias directing attention to science and commerce. This was a world of widespread popular reading where the connections between technical and scientific discovery were seen to be directly related to the central concerns of political economy. Political economists may have looked to science to justify their belief in economic improvement, and scientists may have looked to political economy and commerce to explain a number of scientific advances. At the level of popular culture, however, both middle class and, in certain ways, working class science and political economy were fused in the general ideology of improvement.

The middle classes, at least, conceived of themselves in the midst of a new era dominated by scientific discovery and economic expansion. This attitude is aptly expressed in the prospectus of the widely read Encyclopaedia Metropolitana. The project of such an Encyclopaedia 'derived from the peculiar circumstances of our times', where 'new discoveries in the different branches of experimental philosophy in the last twenty years are unparallelled in the history of human knowledge'. The reasoning behind the plan of the work, divided between pure and applied science, and historical and

lexicographical study,

> 'will be found in the manifest tendency of all the Arts and Sciences at present, from the most purely intellectual even to the labours of the common mechanic to lose their former insulated character, and organize themselves into one harmonious body of knowledge'.[1]

There was also a great range of technical journals for the working classes set up in this period.[2] Many others, such as Fairbairn's mooted project for a working class quarterly called 'The Workshop' never came into being.[3]

The connections between science and political economy become even clearer in the programmes and objects of the scientific movement in this period. It is also true that much of the popular literature I have referred to was itself generated by this movement. This scientific movement of the first part of the Nineteenth Century can be identified as the real attempt to connect science and political economy in everyday culture through the formation of the scientific societies.

By the 1830's there was a great range of such societies reaching practically every spectrum of society. I will limit my attention, however, to the middle class movement. This will comply with the central concern of my thesis, which is to show how political economy and technology provided the key components of a middle class optimism apparent long before the great era of mid Victorian expansion. In speaking of middle class I refer, too, to that limited group combining social and political dominance with cultural hegemony in provincial towns and metropolitan whig-liberal circles. These were the groups which both participated in their own elite literary and philosophical societies, and provided the propaganda and direction for

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1. Prospectus of the Encyclopaedia Metropolitana or Universal Dictionary of Knowledge, to be published 1 January, 1818, p.7
2. The Mechanics Gallery of Science and Art, The Mechanics Weekly Journal and Artisans Miscellany, The Mechanics Oracle and Artisans Laboratory and Workshop, The Repertory of Arts, and The London and Glasgow Mechanics Magazines.
3. W. Pole, ed., Life of William Fairbairn, p.156

working class and petit bourgeois scientific organization. Most of what follows will deal with the Mechanics Institutes Movement and with the development of the literary and philosophical societies with their subsequent institutionalization within the British Association for the Advancement of Science. I will also look at the Statistical Movement, which was generated within the British Association, and which became in many provincial areas, the follow-up to the Mechanics Institutes Movement.

I will be concerned primarily here with the state of the movement in the 1820's and 1830's, perhaps the two most striking phases of the diffusion of popular science since the formation of the first literary and philosophical societies in the Eighteenth Century. One must bear in mind that many of the dominant trends in the movement in this period do, however, emerge much earlier.

Useful Knowledge and Eighteenth Century Culture

The literary and philosophical societies first gained local significance in Eighteenth Century northern provincial society. The role these societies played in the Eighteenth Century was somewhat different than in the course of the Nineteenth Century. The Lunar Society of Birmingham (1768), the Manchester Literary and Philosophical Society (1783), the Newcastle upon Tyne Lit. and Phil. (1792), and the Glasgow Philosophical Society (1802) all made science an integral part of a class self image. Both Arnold Thackray and Stephen Shapin have noted the role of these societies in filling a cultural void, and in providing for the legitimation of 'men of marginal status'.[1] These societies were concerned with the diffusion of enlightenment and culture to its commercial classes. Such concerns, wrapped in utility, were the

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1. Stephen Shapin, 'The Pottery Philosophical Society 1819 - 1835: An Examination of the Cultural Uses of Provincial Science', Science Studies, 2, 1972, and Arnold Thackray, 'Natural Knowledge in a Cultural Context: The Manchester Model', American Historical Review, 79, June, 1974, 687

subjects of early lectures to the Manchester Lit. and Phil. Thomas Henry read a paper in 1781 'On the Advantages of Literature and Philosophy in General, and especially on the Consistency of Literary and Philosophical with Commercial Pursuits'. Henry argued the advantages of science, history, and the useful arts. The 'polite arts' received a rather special place. 'It is a super eminent taste that has distinguished the products of a Wedgwood and a Bentley above their competitors'. And Thomas Barnes lectured in 1782, 'On the Affinity subsisting between the Arts: with a Plan for Promoting and Extending Manufactures, by Encouraging those Arts on which Manufactures Principally Depend'.[1]

An important aspect of certain of the Eighteenth Century societies which clearly distinguished them from their descendants was a strong element of radical intellectualism and Jacobin politics. Thackray indicates an alliance between a lack of establishment status, science, and progressive philosophy.[2] The forty-three members of the Manchester Lit. and Phil. between 1785 and 1790 included luminaries such as Erasmus Darwin, Percival and Priestley, fifteen associates of the Unitarian Chapel, and the Jacobin activists, Thomas Walker, Thomas Cooper, James Watt Jr., and Samuel Jackson. These latter members withdrew after the society refused to support Priestley during the Priestley riots.[3] The Derby Philosophical Society, in contrast, did send letters of support.[4] Political subjects were common in this earlier period. Matthew Robinson Boulton, brought the latest news of political developments in France to the Lunar Society.[5] Coleridge spoke to the Manchester Society on pantisocracy. Percival, in 1790, addressed it on

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1. Memoirs of the Manchester Lit. and Phil. Society, i, pp. 7 - 29 and 72 - 89
2. Arnold Thackray, 'Natural Knowledge', p.687
3. Memoirs of the Manchester Literary and Philosophical Society, (third series), ix, 1883, 171 - 173
4. A. E. Musson and Eric Robinson, Science and Technology in the Industrial Revolution, Manchester, 1969, p.197
5. ibid., p.196

'An Inquiry into the Principles and Limits of Taxation as a Branch of Moral and Political Philosophy'. Thomas Cooper defended the political and social rights of women in his 'Propositions Respecting the Foundation of Civil Government', and George Phillips advocated female suffrage in his 'A Necessity of a Speedy Reform in Parliament'.[1]

But a major orientation of the societies was science, and the question remains: why the appeal to science? The writers of the Nineteenth Century looked back on this Eighteenth Century interest in science as indicative of the greater fluidity of English social structure. As an example of this, one writer in the Edinburgh Review in 1820 argued:

> 'Let a philosopher travel where he may in this Island, to the towns, to the country, to our manufactories, to the seats of our great proprietors, of our nobleman, he will never get beyond the pale of rational information; he will be able to indulge in literary or scientific conversation, as long as he continues within the wide circle, which corresponds to British ideas of the society of gentlemen'.

A reviewer in the Athenaeum in the 1830's explained:

> 'But about the middle of the last century, a great change took place in this respect. Some philosophical writers subjected to a minute and exact examination, those branches of science which formed the principal knowledge of men of business, and they were soon induced by that self interest which only influenced them, to adopt the improvements suggested by learning. The advantages accruing from this change excited in them the hope of attaining still further advantages by the application of scientific principles ... their knowledge of the condition in which society then was, made them soon discover in the sciences a power ... they urged on the application of the principles discovered by these researches to the improvement of trades and mechanical arts. Thus scientific knowledge ceased to be the property of a caste; it began to be considered as belonging to the community in general'.[2]

Major attractions to science derived from its status as radical knowledge,

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1. V. A. C. Gattrell, 'The Commercial Middle Classes in Manchester 1820 - 1857', (Cambridge Ph.D. thesis), 1972, p.190
2. [Anon.], 'Education of the Poor in France', Edinburgh Review, xxiii, 1820, p.508, and 'On the Decline of Science in England', The Athenaeum, 8 Jan., 1831, p.25

from the religious values it invoked, and from its 'utility'. A major role in Manchester society was played by the Unitarian ministers. Science was a part of their religious values which stressed liberality in religion, a radical intellectual tradition, and a great confidence in the worth of man and the power of reason. They believed strongly in the formative influence of the environment and had great respect for scientific thought and method.[1] This intellectual interest by the Unitarians was placed at a more practical level by the Methodists. Shapin's discussion of the Pottery Philosophical Societies stresses the methodist view of the acquisition of useful knowledge. 'Through science, God and Mammon might be worshipped at the same altar'.[2]

The science societies of the Eighteenth Century did seem to stress utility as their greatest virtue. Musson and Robinson have argued that, because many manufacturers were passionately interested in utilitarian reasons for the study of science, there could be little doubt that scientific knowledge contributed to the industrial changes of the period.[3] But this assessment gives too little historical treatment to the language and rhetoric of these societies. Did utility simply mean material advantage or did it cover the whole gamut of intellectual and religious values? This caution is clearly expressed by Roy Porter in his discussion of early geology.

> 'The practical utility of science applied to the arts was often seen not in concrete applications, but in general access of understanding, "giving clearness and consistency to a knowledge before obscure and confused", and by giving general and comprehensive views instead of local and confined ideas'.[4]

Many of the societies of the early Nineteenth Century were more

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1. V.A.C. Gattrell, 'The Commercial Middle Classes', pp. 156 - 172
2. Stephen Shapin, 'The Pottery Philosophical Society', p. 320
3. A.E. Musson and Eric Robinson, Science and Technology, p. 189
4. Roy Porter, 'The Industrial Revolution and the Rise of the Science of Geology', in M. Teich and Robert Young, eds., Changing Perspectives in the History of Science, London, 1973, p. 325

exclusively scientific than their Eighteenth Century predecessors. Gattrell argues that after the reaction of the 1790's, the Manchester Literary and Philosophical Society moved away from philosophy, art, and politics, and towards the pure sciences.[1] The societies set up in Leeds and York in 1819 and 1822 emphasized the philosophical parts of their titles.[2]

There were many other societies with similar aims, but rather different social composition from the literary and philosophical societies. Some of these had a definite philanthropic orientation. The Royal Institution founded in 1799 began as a philanthropic organization, emerging from the Society for Bettering the Condition of the Labouring Poor. Thomas Bernard, a founder of both, wished to use science to assist the lower classes and to promote a scientific and systematic philanthropy.

> 'Let us therefore make the inquiry into all that concerns the <u>poor</u> and the promotion of their happiness, a <u>science</u>'.[3]

This was the source of the Royal Institution's bias towards agricultural improvement, but it soon became simply a London centre for fashionable science, meeting the needs of the landed, colonial and mercantile interest.[4] The London Institution, a break-away organization from the Royal Institution was set up in 1805 by City men to bring together the interests of science and commerce.[5] The Surrey Institution (1803), the Philomathic Institute (1807), the General Institute (1805), the Russell Institute (1808), quickly followed in its wake. Similarly inspired bodies emerged some years later in the provinces: the Royal Institution of Cornwall, the Royal Manchester

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1. V. A. C. Gattrell, 'Commercial Middle Classes', p.190
2. A. D. Orange, <u>Philosophers and Provincials the Yorkshire Philosophical Society from 1822 to 1844</u>, York, 1973, p.9
3. Morris Berman, 'The Early Years of the Royal Institution', <u>Science Studies</u>, 2, 1972, 215
4. Morris Berman, 'Royal Institution', p.233
5. J. N. Hays, 'Science in the City: The London Institution, 1819 - 40', <u>British Journal for the History of Science</u>, 7, 1974, 146 - 147

Institution, and the Liverpool Royal Institution.[1]

Science and the Ingenious Artizan

This background for the middle class interest in science also became connected to the particular situation of political economy in the early Nineteenth Century. I have shown how political economy between 1820 and 1840 became increasingly concerned with charting a programme for the progress of wealth, which was contingent not on the genius but on the discipline of the labour force. Political economists drew more attention, as the period progressed, to the precision, regularity and standardization constantly pressing on industry. The scientific interests of the middle classes in the 1820's became directed to a passionate concern for providing a scientific education for the artizan. This took shape within the Mechanics Institutes Movement, a movement peculiarly suited to mediating between the perceived needs of the industrialist and the predictions of the political economist. This chapter will detail the manner in which the Mechanics Institute Movement, and following this, the scientific and statistical movements fitted into the programme for the progress of wealth charted by political economists. The Mechanics Institute Movement and its ingenious artizan was functionally identified with demands for a newly adaptable labour force and with the hardening of social hierarchies within the work process.

The themes and objects of the middle class dominated Mechanics Institute Movement had their origins in a certain amount of prior agitation for working class education. We can find reference to this first in the official histories written by the organizers of the Mechanics Institute Movement. Others have drawn attention to Eighteenth Century and early

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1. M. Berman, 'Royal Institution', p.238

Nineteenth Century artizan natural history and mathematical societies.[1] In addition, several societies in Birmingham dating from the 1780's were described in Lucock's Moral Culture of 1816. The Birmingham Brotherly Association, the Library for the Working Classes, and the Philosophical Institute were all directed to working class education.[2] As early as 1814, Thomas Dick of Methven, Perthshire, complained of social exclusion in existing scientific societies, and stressed the need for societies suited to communicating to the masses the results of scientific research.

> 'The persons admissable as members into such societies are circumscribed within a very narrow circle; the ingenious tradesman and mechanic, however desirous they may be of prosecuting scientific pursuits, however well qualified they may sometimes be for adding to the stores of useful knowledge, are seldom admitted into such societies.'[3]

Timothy Claxton, a few years later, repeated these complaints about the social obstacles to the 'industrious tradesman', and formed a Society of Ingenious Working Mechanics'.[4]

The most celebrated of early efforts at working class scientific education was the mechanics' class at the Andersonian Institute. This was started by George Birkbeck 'for those whose situation had denied them a scientific education.' Birkbeck's class was expanded in 1804 by his successor, Andrew Ure. In 1806 he reported on three lecture courses. The first was a series of popular lectures in 'physical philosophy' attended by women as well as men. The next was his chemistry course in which 'The object of this

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1. See J. F. C. Harrison, Learning and Living 1790 - 1960, London, 1961, p.49; and Thomas Kelly, George Birkbeck, p.66
2. William Matthews, A Sketch of the Principal Means which have been Employed to Ameliorate the Intellectual and Moral Condition of the Working Classes at Birmingham, London, 1830, pp.14 - 15
3. Thomas Dick of Methven, 'Scientific Institutions', Monthly Magazine, 37, April 1, 1814, 219 - 221. Also see Thomas Dick, 'Scientific Institutions (IV),' Monthly Magazine, 38, January 1, 1815, 503 - 506
4. Timothy Claxton, Hints to Mechanics on Self Education and Mutual Instruction, London, 1839, p.23

course is chiefly to develop the connection with the useful arts and to point out its numerous applications to their improvement'. The third course was described as 'The most useful course of lectures', and 'addressed exclusively to the manufacturer and the operative artisan', with the 'elements of mechanical science explained in the simplest and most impressive manner'.[1]

The class was 'discovered' in 1817 by Charles Dupin, and subsequently by a writer for the Encyclopedia Britannica. Dupin in his widely read Narrative of a Tour spoke of the workmen in Glasgow factories who 'understand and explain when necessary the principles of their operations, and the theoretical means of arriving at the most perfect possible practical results'. He commended Ure, not only for his lectures, but for taking him through many important factories, 'the principal of these now directed by his pupils'. Dupin described as typical in Glasgow a world where he met 'some bakers' who made 'machines and philosophical instruments' in their spare time and knew the 'physical and mathematical principles of the instruments and machines which they construct.'[2] Birkbeck's and Ure's classes were also noticed by Dugald Bannatyne in his article on the 'Cotton Manufacture' in the Encyclopedia Britannica of 1818. He proposed the provision of lectures to mechanics in all large manufacturing towns, and saw the scheme as particularly helpful to the advance of the machine making industry. The peculiar suitability of Ure's teaching was already fitted into a conceptualization of technical change.

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1. A. H. Sexton, The First Technical College, London, 1894, pp.27 - 28
2. Review of 'Narrative of a Tour through Scotland in the year 1817 chiefly with a View to the State of its Harbours and Public Works: by Charles Dupin corresponding Member of the French Institute', Quarterly Review, xxii, Jan., 1820, p.55. Dupin's visit, however, was precipitated by a promotional tour of France the year before by Andrew Ure. See W. S. C. Copeman, 'Andrew Ure M.D., F.R.S., 1778 - 1857', Proceedings of the Royal Society of Medicine, August 1951, pp. 654 - 658

> 'invention is progressive, and, in a manufacture extended like ours, it is at the same time diffusive; every discovery that is made, having the effect to unfold principles leading to other discoveries, or to suggest analogous applications in other departments.' ... [operatives] 'have their thoughts constantly turned to the means of enlarging the powers of the machines they are in possession of'.[1]

These classes were well attended with an average membership of 300, and continued to dominate until part of the class broke off from the Andersonian and formed the Glasgow Mechanics Institute in 1823. This seems to have been precipitated by some dispute between members and management and possibly with Ure himself.[2] The real beginnings of the Mechanics Institute Movement lie in 1823 with the formation not only of the Glasgow Mechanics Institute, but the Glasgow Gasworkmen's Library and the Edinburgh School of Art.

The Mechanics Institute Movement, particularly its London centre also had its origins in earlier Radical and Utilitarian education schemes. The Radicals endorsed the principle of secular education for all classes, particularly that which was 'useful and adapted to existing social conditions. In the celebrated 'Chrestomathia' or 'Useful Learning' devised in 1815 by Bentham, James Mill and Francis Place, instruction was to follow a sequence arranged according to the utility of the subject. The basically useful

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1. [D. Bannatyne], 'Cotton Manufactures', Encyclopedia Britannica, 1817, also in Supplement to the 4th, 5th and 6th editions of the Encyclopedia Britannica, iii, Edinburgh, 1824, p.404
2. The general explanation of the origin of the Glasgow Mechanics Institute is that there was a dispute between the directors of the Andersonian Institute and the library committee. But Horner also reports some problems with Ure himself. He wrote in 1825 that 'Ure had given great offence to the students both on account of the manner of co-ordinating the lectures and some exactions about fees', Ure's conduct 'was the main cause of their swarming off'. See Horner to Brougham, 11 January, 1825. He wrote again to Brougham a few years later that he 'was so much accustomed to hear Ure spoken of with reprobation and abhorrence' that he feared 'all is not rights with him'. See Horner to Brougham, 18 January, 1827, Brougham Papers. Notwithstanding, Ure continued to conduct his lectures until 1830 when he left for London to set up as a successful freelance scientific and technical consultant.

subject was science.[1] This Radical programme also received support from the liberal whigs, in particular Henry Brougham who had been involved in both the Lancaster and Chrestomathic schemes.[2] Francis Place formed the most suitable personal connection between these earlier Radical efforts and the Mechanics Institute Movement. He gave an early Radical stamp to the London Mechanics Institute by organizing the first subscriptions from James Mill, the Ricardo family, Grote, Bentham, Hobhouse and Burdett. He brought over to the Movement what Hollis has described as the 'educational neurosis of Francis Place'.[3] Furthermore, he was more sectarian than many of Mill's group. He approached utilitarianism as a body of doctrine. The people were to be taught and to be assimilated to the middle class not in wealth, but in behaviour and attitude. As William Thomas has pointed out, he confused Godwin's image of rational progress with the diffusion of utilitarianism, and both with the progress of technical knowledge.[4] Place was also peculiarly suited to developing the propaganda of the movement. He never forgot his own origins, and never lost the chance of pointing them out. He saw his own experience as enough evidence of the real possibility of working men rising in the world through hard work and education.[5]

There is no doubt that this Radical tradition and its resurgence around the formation of the London Mechanics Institute was quite influential on the subsequent ideological direction of the Movement. However, many of these utilitarian associations lost this connotation when removed from the immediate context. The 'language' of the Movement was sufficiently neutral as to be

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1. J. L. Dobson, 'The Contribution of Francis Place and the Radicals to the Growth of Popular Education 1800 to 1840', (Newcastle Ph.D. Thesis, 1959) pp.84 - 88, and 98
2. A. Aspinall, Lord Brougham and the Whig Party, London, 1927.
3. Quoted in D. J. Rowe, 'Francis Place and the Historians', Historical Journal, xvi, 1973, p.53
4. W. E. S. Thomas, 'Francis Place and Working Class History', Historical Journal, v, 1962, p.63
5. See D. J. Rowe, 'Francis Place', p.49

adaptable to other political programmes and various types of organization. The movement built up its own official history based on earlier technical education through working class effort or provincial organizations. Little reference was ever made to this early Radical political context. The whig-liberal intelligentsia ascendent in provincial and metropolitan political and social life was the only political framework ever assumed.

The official histories also ignored the long tradition of science in the culture of the radical artizan, and in religious dissent. Early Nineteenth Century London republicanism joined forces with the materialist rationalism of the Zetetic clubs, or societies of free enquirers. In the provinces, radical dissent in sects such as the Swedenborgians nurtured scientific rationalism. It was with the support of both of these that someone like Rowland Detrosier acquired great fame as a teacher of science, and established what his sponsors called the first mechanics institutes in England at Hulme and Salford.[1] These traditions merged into the Owenite movement which promoted working class science through such organizations as the Scientific and Utility Societies attached to the first Salford Co-operative Society, an early scheme for a Mechanics Hall of Science,[2] and allied organizations such as the Banksian Society, the Society for the Diffusion of Really Useful Knowledge, and subsequently the New Mechanics Institute in Manchester.[3]

Working class groups, too, had started investigations into statistics and scientific philanthropy long before the full flowering of this movement in middle class circles in the 1830's. The Owenite, George Mudie was turning

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1. Gwyn Williams, 'Rowland Detrosier: A Working Class Infidel', Borthwick Papers, 28, 1965, pp.3 and 9
2. Eileen Yeo, 'Robert Owen and Radical Culture', in Sidney Pollard and John Salt ed., Robert Owen Prophet of the Poor, London, 1971, p.89
3. Gwyn Williams, 'Rowland Detrosier', pp.15 - 16

out a journal in 1823 entitled 'The Political Economist and Universal Philanthropist'.[1] In 1825 another Owenite organization, the 'Committee of Artisans' compiled 'Statistical Illustrations of the Territorial Extent and Population, Commerce, Consumption, Insolvency and Crime of the British Empire'. By the third edition, the group was calling itself the London Statistical Society.[2] It does seem likely that this group emerged from the earlier Select Committee of Artisans of Great Britain which combined the call for repeal of the Combination Laws with Measures for broad social reform. For this group, a strong ammunition of statistical fact was a way of combatting classical economics.[3]

Middle class reformers directed the brunt of their interest in the 1820's to the Mechanics Institute Movement. Middle class circles did not, however, start with control of the movement. Nor did they ever comfortably attain control. The foundation of the various institutes is not simply a narrative of diffusion outwards from a central London organization. The London Mechanics Institute followed fast on the heels of the Glasgow Gasworkmen's Library and the Glasgow Mechanics Institute, both solidly working class organizations.

The London Mechanics Institute itself was initiated at the suggestion of the radical journalists, J. C. Robertson and Thomas Hodgskin. In their Mechanics Magazine of 1823, they wrote,

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1. J. F. C. Harrison, Robert Owen and the Owenites in Britain and America, London, 1969, p.351
2. See Eileen Yeo, 'Social Science and Social Change', p.78. Note that the bulk of this was written by John Marshall who later in 1833 published a summary of the Parliamentary Papers. In 1833 he was Joseph Hume's candidate for head of the Central Statistical Office. See M. J. Cullen, The Statistical Movement in Early Victorian Britain, 1975, p.21
3. See Select Committee of the Artisans of Great Britain, Report of the Bolton Public Meeting, 13 January, 1824. This meeting resolved that machinery reduced the value of labour rather than relieving artisans of their toil, and ought to be taxed. It also resolved that a permanent committee be appointed in London as the focus of information from all parts of the kingdom. pp.2 - 3

> 'The people only want to have the means of educating themselves left in their own pockets untouched by the tax gatherer, and there is no doubt but they will employ those means more for their own advantage than they can possibly be employed by men who, for the very reason that they belong to the upper classes can know little or nothing of what the lower classes need, ...'[1]

But the early ascendency of Place, Brougham and Birkbeck established patronage and control by middle class subscribers. The first patrons of the London society, aside from the Radical circle, included the political economists, Robert Torrens, Nassau Senior, McCulloch, William Ellis, and John Barton; the engineers Taylor and Mortimer; established political figures such as Alderman Key and James Abercrombie, M.P.; and radical figures like Major Cartwright, Cobbett, Hodgskin and Robertson.[2]

Each of the provincial institutes took shape under its own local social circumstances. Members of provincial elites took an active role in the formation of many, ceding more or less than the two thirds control to ordinary members recommended by Brougham. The Manchester, Leeds, Liverpool, Ashton-under-Line, and Nottingham Institutes were started up and controlled by whig-liberal elites.[3] The Manchester Institute was one of solid middle class control, and Benjamin Heywood, the banker, made no bones about this when rebuking Brougham for his criticism of the system of management. He stressed that the Mechanics Institute had not been formed in obedience to any call on the part of the mechanics, but had originated with the employers. It was a philanthropic effort on the part of the employers to place within

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1. The Mechanics Magazine, i, October 11, 1823, 100
2. B. M. Add., Ms.27823 f 269, Place Papers.
3. See M. Tylecote, The Mechanics Institutes of Lancashire and Yorkshire, Manchester, 1957, pp.129 and 253; R. J. Morris, 'Organization and Aims of Classes, 1835 - 1851', (Ph.D. Oxford, 1970), p.258; J. F. C. Harrison, Living and Learning, p.59, Thomas Kelly, History of Adult Education, Liverpool, 1962, p.123; and S. D. Chapman, 'William Felkin', (M.A. Nottingham, 1962), p.119. These indicate the diversity of the origins of some of the provincial institutes.

the reach of their workmen 'the means of improvement'.[1]

Birmingham's institute was more problematic. It is true that a leading part was taken by Joseph Parkes, a well known philosophic radical.[2] But equally, Parkes could report in 1826 that the institute was not supported by the higher educated classes. The fact that the constitution was in the hands of the members had 'given great offence to the higher classes'.[3] The Institute was also strongly influenced by the Birmingham Co-operator, W. Hawkes Smith.

Birmingham's case was not unique, and it is important not to forget both the tradition of 'mutual improvement' in working class culture and the strong scientific tradition in Nineteenth Century radicalism. Those who set up the Glasgow Gasworkmen's Library in 1823 stressed equality and culture. The pre-eminence of the few could only be broken down by measures to alleviate the ignorance and poverty of the many. The value of science was culture. 'Even in our workshops and manufactures will we find many who are little better than parts of the machines around them'.[4] Hawkes Smith claimed the rights of the 'ingenious population' to be instructed in the sciences in general, and not simply in those related to their occupations. He also defended the possibilities for the equalization of education.

> 'When the steam engine was perfected, half the external distinctions of rank vanished; - the new power rendering manufactured articles more accessible. But the effects of scientific advancement will not be branded by the cheapening of silks, calicoes and hardwares. There is an intellectual machinery, a mental steam power at work, and still rising in its action which renders education proportionately as cheap and as attainable to the man of

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1. University College, London (Brougham Papers), Benjamin Heywood to Lord Brougham, 17 February, 1825.
2. G. B. Finlayson, 'Joseph Parkes of Birmingham, 1786 - 1865, A Study in Philosophic Radicalism', Bulletin of the Institute of Historical Research, 46, November, 1973, 186
3. Brougham Papers, Joseph Parkes to Lord Brougham, 13 November, 1826.
4. 'Introductory Address Delivered to the Glasgow Gasworkmen's Library', Glasgow Mechanics Magazine, iv, 29 October, 1825, 171

small means as his clothing and his domestic appointments.'[1]

This pattern was typical of institutes founded by artisans themselves. They sought personal and educational advantages in the context of co-operation in the pursuit of knowledge. The institutes at Keighley, Halifax and Bradford; Stalybridge, Bolton and Hyde; Kendal, Morpeth, and Birmingham were all founded by artisans and in some way carried the banner of 'mutual instruction'.[2]

The working class scientific tradition established at least as far back as the earliest years of the Nineteenth Century, maintained and even increased its strength in these years of the Mechanics Institute Movement. The radical element was never far distant with Robertson as editor of the Mechanics Magazine, and Hodgskin in an influential position in the London Mechanics Institute. Robert Owen became an honorary member in 1827 and lectured in 1830 on 'The Employment of Machinery'. Owenite, Chartist and other radical lecturers featured at the Birmingham, Stalybridge, Sunderland, and Cheltenham Institutes, and appeared periodically at the London Institute. In Manchester, the break-away New Mechanics Institute led by Owenites was set up as a direct challenge to the economic and social assumptions of the Mechanics Institutes Movement.[3] The Owenites were critical of the Mechanics Institute Movement, but continued to endorse the value of education and science. The New Moral World in 1838 called the name 'mechanics institute' a misnomer 'where mechanics are excluded from participation in the management of the institution', 'where their numbers are few compared to other classes (due to long hours of labour), and 'where

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1. W. Hawkes Smith, 'On the Tendency and Prospects of Mechanics' Institutions', The Analyst, ii, 1835.
2. M. Tylecote, Mechanics Institutes, pp.53 - 66, 124, 229, and 241
3. For further details see Edward Royle, 'Mechanics Institutes and the Working Classes, 1840 to 1860', Historical Jrl., 1971, p.318; M. Tylecote, p.125; and Thomas Kelly, George Birkbeck, pp.235 and 252

they are looked on more as individuals receiving a boon from charity'. But still the Mechanics Institutes were commended for having 'done much good'. 'They have awakened dormant intellects ... have been precursors of new thoughts and desires in the bosoms of their attendants'. It saw the 'Social Institution' as the logical sequence to the Mechanics Institutes.[1] Again in 1840 the New Moral World noted that sixty or seventy socialists had seceded from the Coventry Institute and formed a separate establishment, but pointed out that 'the knowledge they had acquired had made them desirous of obtaining more' ... 'so far from the socialists opposing such institutes, they regard them with favour, as half way houses to the attainment of sound knowledge'.[2]

In later years a number of followers of various forms of co-operation, association, and transcendentalism attached themselves to the movement. James Hole and George S. Phillips were involved in the Leeds Redemption Society and the editing of a journal, the Truth Seeker. Hole was active in the Leeds Mechanics Institute and the Yorkshire Union of Mechanics Institute. He became known for his 'Lectures on Social Science and the Organization of Labour' and his pamphlet on the Mechanics Institutes. George Phillips had close connections and great influence over the Huddersfield Mechanics Institute.[3]

The independent itinerant scientific lecturer also continued to attract large followings of youths and mechanics. These ranged from famous spectacular performances such as that of Thomas Sadler with his Montgolfier balloon to radicals like Detrosier, and the shoemaker philosopher Thomas Morrison, down to the self appointed seer of the local public house.[4]

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1. The New Moral World, 1 September, 1838.
2. See Royle, 'Mechanics Institutes', p.318
3. J. F. C. Harrison, Learning and Living, pp.127 and 140 - 142; M. Tylecote, Mechanics Institutes, p.70
4. See I. Inkster, 'Science and the Mechanics Institutes, 1820 - 1850, The Case of Sheffield', Annals of Science, September, 1975, p.406

This indigenous working class activity and increasing socialist involvement put the middle class supporters of the Mechanics Institute Movement into a certain predicament. The movement began to justify the inclusion of entertainment and even religion and politics in programmes on the grounds that the socialists now had institutes which included not only religion and politics, but science as well. I will take up this shift in emphasis and its causes in more detail later. But it seems plausible to ask to what extent this working class and socialist scientific activity was an important factor influencing the later change in the orientation of the Mechanics Institutes Movement. To what extent did the reality of this socialist science lead to the 'dissipation' of the ideological specificity of the middle class scientific movement?

Ingenuity and Industry: The Workshop and the Factory

There can in fact be no rigid classification of the ideology of the Mechanics Institute Movement. As noted, organization and management differed according to local circumstances. Similarly, justifications, programmes and ideas had their local peculiarities. Periodisation too cannot be rigid. It is difficult to be precise about the timing of any sharp shift in orientation. It is generally believed that the movement changed away from the focus on science somewhere between the late 1820's and the early 1830's. But there is still evidence of the older style imagery re-emerging in the 1830's, and it is important that the scientific programme maintained significant importance in the industrial areas even into the 1850's.[1]

The plethora of introductory addresses, the work of various mechanics

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1. D. S. L. Cardwell, The Organization of Science, p.74. The 1851 Census noted the location of the various institutes and the nature of their classes. It found the greatest concentration of science classes in South Lancashire, the West Riding, Tyneside, Southampton, Devonport, and the Cornish Mining areas.

journals, and a number of reports on the progress of the movement do, however, allow for some systematic assessment of overall themes and images. Most of the early societies stressed some form of egalitarianism and social mobility. Most debated over the significance of the development of skill and science as applied to the arts. Finally, most fostered a piecemeal, empirical view of technical change.

Few of the founders of the movement envisaged any contradiction in their statements on the role of abstract science as opposed to the role of empirical skills. They generally hoped for some optimal combination of the two. James Hole's view though stated much later, did sum up the views of the earlier period.

> 'The nation which possesses the largest number of skilled artizans, capable of availing themselves of the aids which science lends to industry, will, ... be the richest nation'.[1]

But the founders were anxious to stress that science did have some direct connection. At its most extreme, this was voiced in the view that the origins of the steam engine were to be traced to Black's research into the nature and properties of latent heat with Watt's discoveries as a logical extension of this.[2] Brougham's views at the outset were also somewhat extreme and untypical. He stressed that few great discoveries were made by chance and by ignorant persons - that Watt's discoveries were based on a learned investigation of mathematics mechanics and chemistry, and that even Arkwright had devoted five years to the invention of the 'spinning jenny' and was conversant with everything that related to the

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1. James Hole, An Essay on the History and Management of Literary, Scientific, and Mechanics Institutes, London, 1853, p.49
2. First Report of the Directors of the School of Arts of Edinburgh for the Education of Mechanics in such Branches of Physical Science as are of Practical Application in their Several Trades, May, 1822, p.12

construction of machinery.[1] Most of the provincial institutes simply drew a loose connection, as did the Darlington Institute to the interactions between science and the artisan. The knowledge of science would 'acquaint them [the working classes] with more certain rules than the mere imitation of what they have seen done by another', and there was 'no trade which does not depend more or less, upon scientific principles'.[2]

James Hole's statement of the relations between science and industry was the much more common one. Such an attitude often involved a mystical view of the artisan. The imitation and instinct of a machine or 'Indian weaver' were often contrasted to the innovative spirit of the educated artisan. The institutes by 'adding knowledge to your industry and skill', would lead to 'rich veins of practical talent' 'brought to light'.[3] The imitative behaviour of the Indian weaver whose process had remained the same for centuries was contrasted with the observant mind of a Hargreaves. Changes were brought about by observation followed by inquiry involving the principles of science.[4] Aside from this Baconian view of the advance of science on the basis of the number of educated artisans, there was also the view of science as a cultural antidote to the division of labour. James Hole quoted Lyon Playfair to support his view that the division of labour had been carried to extremes. He saw science as a '<u>synthesis</u> of labour' - or 'the bringing together the knowledge required in each department of industry'.[5] Science was to be 'injected' into the workshops, and men daily employed in handling tools and working amongst the elements

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1. [H. Brougham], 'A Discourse on the Objects, Advantages, and Pleasures of Science', London, 1827 (printed in the Library of Useful Knowledge, London 1829), pp.39 - 44. The leaders of the Movement were often careless with their history of technology.
2. <u>First Report of the Mechanics Institute of Darlington</u>, Darlington, 1826, p.7
3. Benjamin Heywood, <u>An Address Delivered at the Opening of the Manchester Mechanics Institute</u>, 30 March, 1825, p.15
4. M. Tylecote, <u>Mechanics Institutes</u>, p.131
5. James Hole, <u>History of Mechanics Institutes</u>, p.49

of mechanical science would be the best suited to making discoveries and inventing improvements. Brougham singled out Watt as the model to the members of the institutes. He saw it as 'their own fault' if they did not 'rise out of their level' and 'take the chances of making discoveries which would secure them affluence and the fame of extending the boundaries of science and art'.[1]

Brougham used his opportunities to point out that ingenious models and apparatus were frequently brought forward 'by persons from whom little beyond ordinary handicrafts would have been expected'.[2] The Glasgow Mechanics Magazine advised workmen to keep a pencil and notebook while at their work to record observations and ideas. There was also no lack of schemes for patent protection of artisan inventors. The Wakefield Mechanics Institute included assistance, when funds would permit, to members for the patenting of any useful inventions they might make.[3] The Mechanics Magazine in 1825 announced steps towards the formation of a joint stock company, 'The British Invention and Discovery Company for the Assistance, Encouragement and Protection of Native Genius, and the Profitable Investment of Capital in the Prosecution of Original Inventions and Discoveries by British Subjects.'[4]

This combination of science and industry was ascribed to a purely metaphysical foundation. There was rarely any attempt to specify the connections or to test the models and folk heroes put forward. The combination was, however, closely connected to the social ideals of the movement. In one sense the 'artisan inventor' was a direct challenge to the aristocracy of theory. Discovery was to become an everyday employment, and not an

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1. Address of Henry, Lord Brougham to the Members of the Manchester Mechanics Institute, 21 July, 1835, p.172
2. H. Brougham, Practical Observations Upon the Education of the People Addressed to the Working Classes and their Employers, London, 1825, pp.26 - 32
3. J. F. C. Harrison, Learning and Living, p.64
4. Mechanics Magazine, iv, 23 April, 1825, 43

'exclusive philosopher's right'. As late as 1837, the President of the Bradford Mechanics Institute could exclaim:

> 'Who can tell but that some happy thought, suggesting itself to the mind of an hitherto obscure member of a Mechanics' Institute, may pave the way to results, far surpassing in splendour and usefulness those which the genius of a Watt, a Boulton, or an Arkwright has achieved'.[1]

There may, indeed, have been a sense in which the empiricist approach of the movement was political. The inductivist movement during this period was a challenge to the theoretical enclaves of metropolitan science and classical political economy. However, it is important to note that the challenge to the exclusiveness of intellect was a very measured challenge. Much of the verbiage was aimed at a particular type of workman. The practical man was to hold the key place in the development of industry. But the 'mechanic' the institutes envisaged was a new type of workman evolved by the methods of industry itself. The heroes of the movement were not typical London artisans. The 'new race of philosophers' was a particular corps within the working class. In its very definitions, the movement was organized around the heirarchical divisions in the labour market.

The engineering industry, from which the movement took much of its rhetoric and example, was a case in point of these divisions and hierarchical tendencies in the labour market. The many new skills recently arising within the engineering industry were the result of a successful subdivision of the work. The old corn millwright and early millwright engineer of the Eighteenth Century was an all round skilled craftsman, and his craft was highly exclusive.[2] One had to be 'born and bred a millwright' in order to

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1. J. F. C. Harrison, Learning and Living, p.64
2. Jennifer Tan, 'The Textile Millwright in the Early Industrial Revolution', Textile History, v, October, 1974, p.81

gain entry to the trade.[1] With the emergence of new factory millwork and the early steam engine, came a new demand for millwrights, and with it a two edged process of levelling of craft skill and professionalization. When Smeaton established the Society of Civil Engineers in 1771, he complained,

> 'Not only are all the inferior departments ambitious to become practical engineers, but even members of the committee have a propensity that way too - by which means all becoming masters and he who ought to be so being deprived of authority, it is easy to see the confusion that must follow'.[2]

Professionalization of some members of the trade was established through membership in the Smeatonian Society and education in the Dissenting Academies.[3]

The introduction of the Boulton and Watt steam engine brought the emergence of the late Eighteenth Century, early Nineteenth Century 'trouble shooting' Boulton and Watt engine erector. The introduction of the steam engine brought new demands for millwork, but it 'nevertheless lowered the profession of the millwright and levelled it in a great degree with that of the ordinary mechanic.'[4] Fairbairn described the history of the training up of workmen in the early engineering industry, then the gradual removal of their skills. Accurate fittings could not be secured as long as manufacture was conducted by hand. The introduction of new tools brought greater precision, but in addition,

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1. William Fairbairn, Treatise on Mills and Millwork, London, 1861, Part I, pp. vi and ix
2. Sidney Pollard, The Genesis of Modern Management, p.157
3. J. Tan, 'The Textile Millwright'.
4. William Fairbairn, Treatise on Mills, p.vii. Dr. Tan also found that the dimensions of early factories were nearly constant. Even though the basic plan of the factory was decided by the millwright or engineer in consultation with the manufacturer, still the process was standardized enough so that there were a number of builders' manuals with details of acceptable forms for doors, windows and even cupolas. The Development of the Factory, London, 1970, pp.103 and 149

> 'The facilities thus afforded led to a constant progressive improvement in the character of the work done, at the same time constantly reducing the dependence on mere manual skill'.[1]

Growing recognition of the advantages of standardization and interchangeable parts, along with demands for absolute and uniform accuracy led to extensions of the engineer's workshop as a part of the process of building skill into the machine. By the 1820's and 1830's there was a broadly based skilled hierarchy of engineering workers in the engineering plants of the Midlands and the North. James Nasmyth, James Fox, Matthew Murray, Sharp, Roberts and Co., Hicks, Hargreaves and Co., Fairbairn and Lillie, and Joseph Whitworth were directing large scale machine shops, foundries and engine factories.[2] The high degree of specialization is depicted by the workforce of Peel, Williams and Co., which by the early 1820's, at the very least, included a principal engineer, draughtsmen, hand clerks, engineers, millwrights, pattern makers, fitters, turners, moulders in brass and iron and boilermakers.[3]

With the breakdown of the craft there emerged new closely knit trade societies. One finds in 1824 the establishment of the Steam Engine Makers' Society, in 1826 the Society of Journeymen Steam Engine, Machine Makers, and Millwrights, and in 1830 the Associated Fraternity of Iron Forgers.

Professionalization proceeded alongside this, as the mental-manual distinctions of the trade became more formalized. The exclusiveness of the Smeatonian Society was challenged in 1818 by a new Institute for Civil Engineers, to include those engaged in public works and transport. New

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1. W. Pole ed., Life of William Fairbairn, p. 39. This process was taking place rather later in the 1820's and 1830's in Cornish engineering. The foundry came to usurp the position of the independent engineer and produced engines to standard designs. See D. B. Barton, The Cornish Beam Engine, Truro, 1966
2. L.T.C. Rolt, Victorian Engineering, Harmondsworth, 1974, pp. 131-135
3. A. E. Musson, 'An Early Engineering Firm: Peel, Williams, and Co. of Manchester, ' Business History, iii, 1960, p. 14

reasons for professionalization were devised. The society was to provide a forum for reading practical papers and for assigning professional status. H. R. Palmer, in opening it, argued

> 'An engineer is a mediator between the philospher and the working mechanic, and, like an interpreter between two foreigners, must understand the language of both ... Hence the absolute necessity of possessing both practical and theoretical knowledge.'[1]

Similarly such professional status was given to railway engineers with the emergence in 1846 of the Institute of Mechanical Engineers, so that

> '... by a mutual exchange of ideas regarding improvements in the various branches of Mechanical Science,'

they might

> 'increase their knowledge and give impulse to mechanical Inventions likely to be useful to the World'.[2]

The history of the engineering industry provided the desired evidence to the Mechanics Institute Movement of the emergence of the gap between the professional and the worker. The formal definition of these new labour hierarchies was fixed in the minds of the middle class promoters of the Mechanics Institute Movement. This is aptly characterized by one of Benjamin Heywood's remarks in 1837. He described the workmen of Sharp, Roberts and Co. as 'of the first class as regards skill and rather high wages'. One learns more of the perceived social status of these workmen, however, from his complaint which followed, 'it would be well if their habits corresponded with their skill'.[3]

The Mechanics Institute Movement focused on the highly skilled sector of the working class, but ignored the historical breakdown of skills even within these 'privileged' groups. It acted to give formal recognition and new precedence to the emerging gradations and hierarchies in the labour

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1. W. H. G. Armytage, Social History of Engineering, p.123
2. ibid., p.131
3. Brougham Papers, Benjamin Heywood to Lord Brougham, 28 Sept., 1837.

force, such as I have described for the engineering sector. In effect the aims of the Mechanics Institute Movement appeared to be the dual ones of extending the supply of skilled labour, and yet of limiting the mobility of this labour into the middle classes. The 'skilled labourer' in this period acquired new class connotations in both a social as well as a technical sense. The movement promoted the role of the skilled labourer, yet its appeals to social mobility were in contradiction to the new social barriers it was, in fact, contributing to erect.

This process is certainly borne out by the rhetoric of the movement. The first provisional committee of the London Mechanics Institute defined as mechanics all who earned their living by the work of their hands, but included the proviso that if the institute became overcrowded, preference would be given to those in the trades who worked for daily, weekly or quarterly wages.[1] The successful mechanics institute in effect as well as idea was seen to act as a labour exchange for superior workmen. Heywood claimed that many members of the Manchester Mechanics Institute had been 'raised in the conditions of life'. 'Masters wanting superior workmen, foremen or overlookers, are beginning to come here to inquire'.[2] Brougham also stressed the pecuniary benefits of scientific instruction, and was at no loss for examples of the great engine maker taking men of humble rank for important posts because of their knowledge of science'.[3] Apostles spoke of the 'getting up of a new aristocracy - an aristocracy of science, composed exclusively of the working orders, which is to be the enemy and

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1. Thomas Kelly, George Birkbeck, p.86. Kelly takes pains to point out that this was not a deliberate preference for a superior type of artisan, but a preference for those who because of the nature of their work were most likely to benefit. But this argument is circular. The type of workforce aimed at was the basis of the type of instruction.
2. Benjamin Heywood, 'Sixth Address', 26 Feb., 1835 in Heywood, Addresses delivered at the Manchester Mechanics Institute, London, 1843, p.34
3. /H. Brougham/, Practical Observations upon the Education of the People, London, 1823, pp.12 and 15

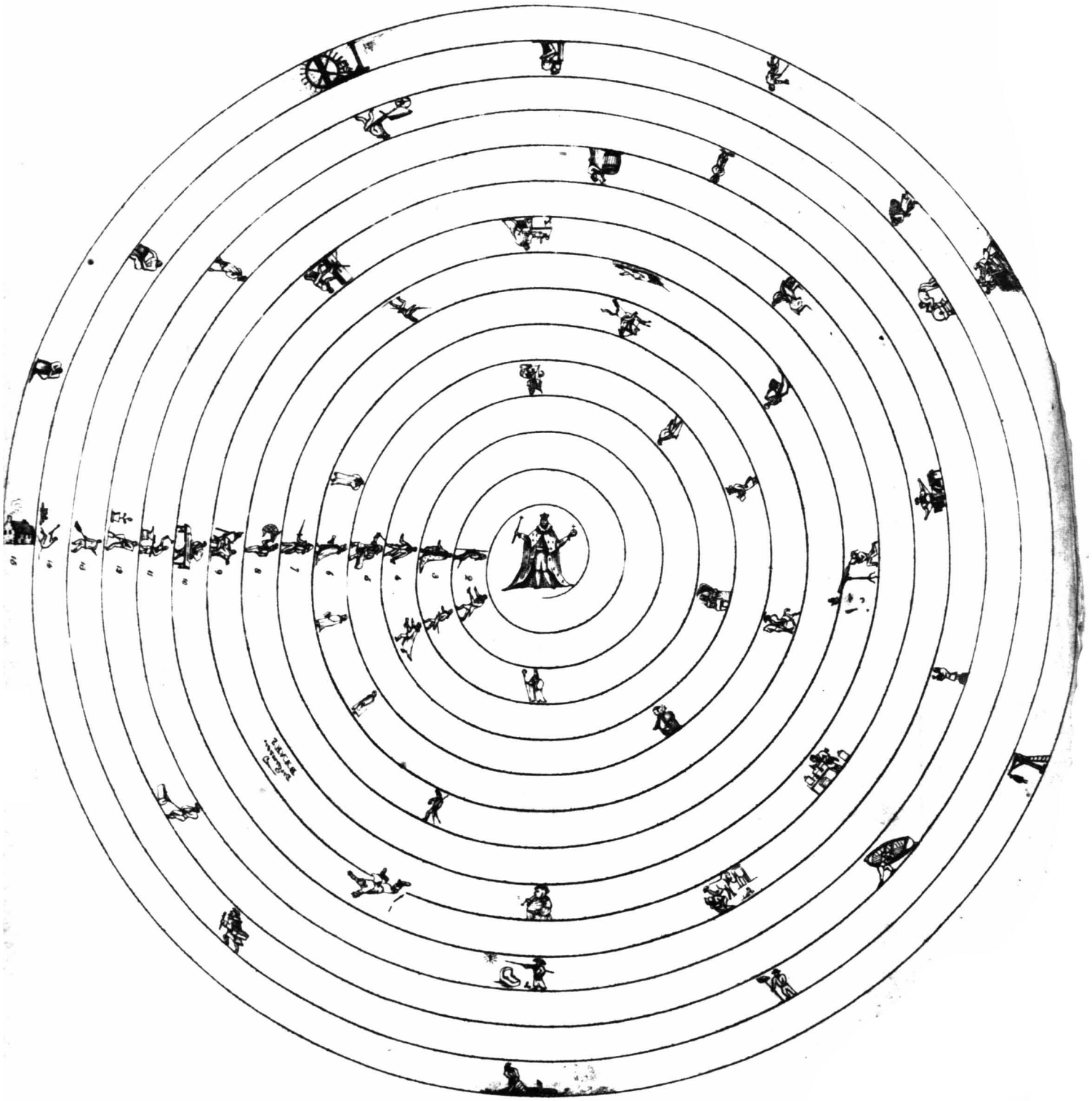
ruler of the old'.[1] The Mechanics Institutes were seen as a way of meeting the social change consequent on scientific advancement. James Martineau spoke to the Liverpool Mechanics Institute of machinery 'rapidly supplanting human labour and rendering mere muscular force' ... 'worthless' ...

> 'That natural machine, the human body, is depreciated in the market. But if the body have lost its value, the mind must get into business without delay'.[2]

His was a new world where 'Mechanical invention, and not mere labour, is the great source of national wealth'.[3] The hierarchy of labour found vivid expression in Richard Burnet's success spiral. The spiral traced out the position of all in society, and was kept moving by the social assumption that the best informed and most industrious always moved forward by thrusting out the more ignorant. The spiral was based on the concept of society as a system of ranks. 'Rank keeps the labouring classes from combining into a whole'.[4] But rank too implied the idea of duty in order to relate ranks divided by huge inequalities of wealth and privilege in a framework of mutual obligation.[5] Burnet suggested his spiral be displayed in all Mechanics Institutes in order to stir up a spirit of emulation.[6] But even the unprecedented position of this new class of scientific and technical workers was to be limited. The assumption of a strict distinction between employer and employed was seldom challenged by middle class founders. Leonard Horner stressed that his School of Arts was to 'give some select instruction to the mechanics in those branches of science which will be of use to them in the exercise of their trade, 'to give them education suited to their

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1. Richard Burnet, A Word to the Members of Mechanics Institutes, Devonport, 1826, p.67
2. W. Hawkes Smith, 'On the Tendency and Prospects of Mechanics Institutes', p.336
3. Mechanics Magazine, quoted in M. Tylecote, Mechanics Institutes, p.33
4. Richard Burnet, A Word, p.66
5. R. J. Morris, 'Voluntary Organizations of Leeds,' pp.113 - 114
6. Richard Burnet, A Word, p.21



Drawn & Engraved by C. Banks, Davenport.

THE WHEEL OF SUCCESS

Let us, therefore, place the universal good-- the object of every man's ambition - the grand desideratum of all, as a centre, around which a spiral, in the form of a volute, or pyrotechnical wheel, of fifteen revolutions, should be drawn. At the extreme point the work house should be fixed. The radius from it should be described by the figure of a man, at the bisection of each revolution, to represent the head of every class in society. The internal orbicular lines should be filled up with the different classes, shaded downwards in proportion to their relative situations or stations in life.

We will, therefore, place the king on the inner circle.

The ministers of state on the second.

The members of the House of Peers on the third.

The members of the House of Commons on the fourth.

The heads of professions, professors of the universities, judges, first rate merchants, generals, Braham, Talma, Keen on the fifth.

First class barristers, aspiring to be judges; colonels, looking for the rank of general, etc. on the sixth.

The seventh should contain middle class barristers, captains etc.

The eighth lieutenants etc.

The ninth, mechanics, and others, earning more than forty shillings a week.

The tenth, mechanics and others earning between twenty shillings and forty shillings.

The eleventh, those who earn less than twenty shillings.

The twelfth, labourers who earn more than twelve shillings.

The thirteenth, labourers who earn less than twelve shillings.

The fourteenth, paupers, having casual relief only.

The fifteenth, paupers in the work house. ...

/The Wheel of Success

The best informed and the most industrious will always, in their exertion to get forward, thrust out the more ignorant in the rear.

...

If diagrams of the kind described were suspended in Mechanics Institutions, and every member were furnished with them, they would stir up a spirit of emulation, and have a marked effect on society.

Richard Burnet, A Word to the Members of Mechanics Institutions, Devonport, 1826, pp. 17 - 21

circumstances'. He maintained that there must be 'master mechanics in the direction of the institutes to prevent anything being done contrary to the habits and feelings of the workmen'.[1] This reality of the appeal to a hierarchy of skilled labourers was directly at variance with much of the mythology of the movement. The founders generally held fast to the image of the humble inventor and made much of the spectacular success story.

But there was one at least who challenged the conception of innate workshop genius.

> ... 'The mechanics of Great Britain can claim no merit as mere workmen, which every machine in the country may not claim just as well ... Not a class of men can be mentioned, whose avocations place them more in the way of those discoveries by which the arts and sciences are improved, and the resources of a country augmented; it is their constant business, in fact to be making those changes in material substances by which are their capabilities are best developed; and yet where are the great discoveries in art or science, that can be fairly traced to the observations of the workshop? ... by far the greatest number of those discoveries ... by which even the arts themselves have been improved ... have been made out of the workshop'.[2]

There was some attempt to tone down the success stories in a later period. It was said of the mechanical drawing and chemistry classes that 'if from such classes does not spring a James Watt, or a Christopher Wren, a Simpson or a Davey, yet from them come supervisors of railway works, foremen of foundries and machine makers' establishments, and "clerks of the works" at the erection of great public buildings'.[3] And a witness to the Select Committee on Arts and Manufactures argued that ten years of experience of the institutes had produced some social mobility, as well as 'more skilful constructors, more ready contrivers, more expert workmen, and

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1. Brougham Papers, Leonard Horner to Lord Brougham, June, 1824.
2. 'Tom Telltruth', The Mechanics Magazine, i, 22 November, 1823, 196
3. Quoted in M. Tylecote, Mechanics Institutes, p.262

more tasteful designers'.[1] Commentators also touched a constant source of anxiety - the difficulties of diffusing new techniques. It was claimed that the operative had a conservative outlook on the work process because he mechanically followed rules laid down for him and became attached to a certain way of working. This was part of the explanation of 'why improvements are so ill received among the working class of society'.[2] The more realistic claims that the Mechanics Institutes produced more skilled and more adaptable workmen placed the mythology of the humble inventor squarely within the hierarchical aims of the movement. The Mechanics Institutes provided an instrument of social discipline rather than one of social mobility.

Moral virtue was an intrinsic part of the ideology of science for the working man. Industry and temperance were the virtues of the good mechanic. Benjamin Heywood expressed the middle class fears of anarchy in the heart of the metropolis.

> 'living as they do in the midst of a dense and teeming population, I'm thoroughly persuaded that the best and easiest method which they can adopt for obviating the risks necessarily incidental to such a state of society, is by diffusing ... sound and useful knowledge ... which imparts those principles in which are ever to be found the safest guides for individual conduct, and the surest guarantee of public order'.[3]

These concerns led to emphasis on the moral advantages of knowledge. Education was 'to rouse the mental activity', 'to teach them [the poorer classes] the acute discernment of their best interests'. The Mechanics Institutes were, to 'fit men more wisely to direct their own conduct in whatever

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1. Select Committee on Arts and Manufactures, 1835, v, Q 1554, p.114, PP.1835. There are similar comments in the Select Committee on Education in England and Wales, Appendix No.2, P.P.1835, vii, pp.105 and 110
2. 'On Founding an Institute for the Cultivation of Mechanical Science' - letter to the Editor of the London Journal of Arts, July, 1822 in Place Papers, B. M. Add., Mss.27824 f 31
3. B. Heywood, 'Address', 14 Jan., 1834, Addresses, p.72

situation they may be placed in society'.[1] They would direct the habits of the working class to 'respect for the laws' and 'that due subordination of rank on which the well being of every gradation in society depends'.[2]

This concentration on morality provided the point of entry for both the church and political economy. Both religion and political economy were important influences on the movement from its inception, and this influence grew stronger over the years, particularly after the first decline of the movement in the late 1820's.

Political Economy for Mechanics

It was, in fact, always taken for granted that a certain type of political economy should be taught in the Mechanics Institutes. Political economy had become the peculiar creed of the middle classes. The great work of popularization began in the 1820's. Political economy was presented as a science which could explain the triumph of British industry and British economic supremacy. It justified claims to middle class superiority and offered a millenial picture. The political economy of the popularizers displayed the natural laws by which the economy and society operated, explained all social problems in terms of the violation of these laws, and encouraged the view that submission to the laws led to infinite progress. One of the focal points of popularising political economy was a supreme concern for the problems of production, and as a corollary of this, the

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1. W. P. Gaskell, An Address to the Operative Classes, being the Substance of a Lecture Explanatory and in Defence of the Nature and Objects of the Cheltenham Mechanics Institute, 8 May, 1835, pp.4 - 7. Also see Suggestions regarding the Object and Management of Mechanics Institutes, Manchester, 1830 [attributed to William Rathbone], pp.8 - 9
   A Lecture Delivered on the Opening of the Sheffield Mechanics Institution on the 14th of January, 1833 by the Reverend Thomas Allin, Sheffield, 1833, p.16
2. Observations addressed to all Classes of the Community on the Establishment of Mechanics Institutes, Derby, 1825, p.9

absolute benefit of machinery.[1] The Mechanics Institutes were thus a natural place for the interests of political economy.

The Mechanics Institutes were generally left in the hands of the popularizers. They did, however, attract the patronage of certain key figures in the establishment of economic theory. McCulloch [in his Principles of Political Economy] discussed the place of the Mechanics Institutes. He claimed that they gave the working classes an opportunity to perfect themselves 'by learning the principles on which they [their arts] depend'.

> 'The lustre which now attaches to the names of Arkwright and Watt may be dimmed, though it can never be wholly effaced, by the more numerous, and, it may be, more important discoveries that will, at no distant period, be made by those who would have passed ... in the same obscure and beaten track as by their unambitious ancestors, had not the education now so generally diffused, served to elicit and ripen the seeds of genius'.[2]

The reviewer of his 'Discourse on the Rise and Progress of Political Economy' suggested the pamphlet for use in the Mechanics Institutes where the artisans 'learned things far more difficult and less interesting every day', and he did not doubt that 'when the doctrine of wages and population is clearly explained at these institutes, they will be eagerly listened to'.[3] By 1829, a mutual instruction class at the London Institute was using McCulloch's Principles.[4] McCulloch also gave the introductory address to the London Literary and Scientific Institute, formed for lower middle class

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1. R. K. Webb, The British Working Class Reader, 1790 - 1848, London, 1955, p.99. For further work on the popularizers see W. F. Kennedy, 'Lord Brougham, Charles Knight and the Rights of Industry', Economica, xxix, Feb., 1962; and R. Gilmour, 'The Gradgrind School of Political Economy'.
2. J. R. McCulloch, Principles of Political Economy, p.119
3. 'Review of J. R. McCulloch's Rise and Progress of Political Economy', Edinburgh Review, xliii, Nov., 1825, 14
4. Birkbeck College, London, Minutes of the London Mechanics Institute, 3rd October, 1831, iii

clerks. The committee included businessmen and political economists. Among these were John Smith M.P., James Mill, C. P. Thomson, William Ellis, Alexander Baring and S. Jones Lloyd. Here the study of political economy was justified as the path to social mobility. The hero now was Ricardo who 'entered on that great arena which you have entered with prospects probably inferior to those of the majority amongst you'.[1]

Aside from McCulloch, both Torrens and Senior took an active part in the early life of the movement. Torrens was among the first subscribers, and also took part in the speeches of the first anniversary of the London Institute.[2] Senior frequently offered or adjudicated essay prizes for topics on political economy. From 1831, he offered prizes for essays on emigration, the distribution of revenue, combinations, and capital and wages.[3] Babbage contributed the third edition of his Economy of Manufactures along with one hundred copies of his chapter 'The New Principles of Manufacturing'.[4] John Barton was a member of the First General Committee of Managers of the London Mechanics Institute,[5] and T. Perronet Thompson was asked several times in 1837 to lecture at the London Institute.[6]

The systematic teaching of popular political economy was regarded as central to the artisan's education in much the same way as was practical science. The institutes became a centre for a burgeoning industry in popular political economy. Most of this work was middle class propaganda of the crudest kind. Francis Place was a keen advocate of this political

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1. J. R. McCulloch, A Discourse Delivered at the Opening of the City of London Literary and Scientific Institution, 30 May, 1825, London, 1825, p.27
2. See 'London Mechanics Institution', 23 April, 1824, Place Papers, Add. Ms.27824, f. 43
3. 'Address to the London Mechanics Institute', 3 December, 1831, Place Papers, Add. Ms.27824, f. 150. Also see Minutes of the London Mechanics Institute, 28 January, 1833, iv
4. Minutes of the London Mechanics Institute, 18 March, 1833, iv
5. See J. Sotiroff, John Barton, Economic Writings, i, Regina, Sask, 1962, xi
6. Minutes of the London Mechanics Institute, 17 April, 20 Aug, 13 Nov., 1837.

economy, and Brougham produced a series of lectures for use in provincial institutes. Thomas Chalmers believed that the Mechanics Institutes worked the 'greatest of economic improvements' by giving a 'higher tone to the character' and leading to later marriages.[1] Political economy had a definite role in the Institutes as he

> 'was not aware of a likelier instrument than a judicious course of economical doctrine for tranquilizing the popular mind and removing from it all those delusions which are the main cause of popular disaffection'.

Political economy was a 'sedative to all sorts of turbulence and disorder'.[2] Further, the attention drawn by Chalmers to the affinity between 'the taste for science' and the 'taste for sacredness'[3] became at a much later date the principle behind the co-operation of the church and the mechanics institutes. Political economy within the institutes taught moral virtue, and the church was quick to follow in this role.[4]

The promotion of the teaching of political economy was accompanied by the emergence of popular lecturers. The best known of these at the London Institute were William Ellis and Wilmot Horton. Ellis' teaching was constantly urged on the London Institute by Francis Place. Ellis sat on the Committee and adjudicated essay prizes.[5] He held a discussion group at the institute on social issues, which was published in 1829 as 'Conversations Upon Knowledge, Happiness, and Education'.[6] His lectures to the London Literary Society were probably used by Brougham as the core of the famous

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1. Thomas Chalmers, 'On Mechanics Schools and on Political Economy as a Branch of Popular Education', Glasgow Mechanics Magazine, v, 3 June, 1826, 217 - 221
2. Thomas Chalmers, 'On Mechanics Schools and On Political Economy as a Branch of Popular Education', Glasgow Mechanics Magazine, v, 24 June, 1826, 262 - 268 and 1 July, 1826, 285 - 288
3. Thomas Chalmers, 'On Mechanics Schools', 218
4. See /Thomas Coates/, Report on the State of Literary, Scientific and Mechanics Institutes in England, S.D.U.K., 1841, p.15 for evidence of the religious affiliations of newly formed institutes.
5. Minutes of the London Mechanics Institute, 31 October, 1831, iii
6. E. E. Ellis, Memoir of William Ellis, London, 1838, pp.18 - 20

Brougham lectures on political economy.[1] Ellis ran a session of lectures at the Institute in December, 1832.[2]

Meanwhile Wilmot Horton had given his lectures, 'Statistics and Political Economy especially with reference to the Condition of the Operative and Labouring Classes' in December 1830.[3] In 1830 Horton also had the idea of discussing his emigration schemes with a group of working men. Birkbeck arranged a group for him at the London Mechanics Institute. These discussions were followed by a series of ten lectures, reported to have been very bad.[4] Horton's lectures are also reported to have raised some turmoil. He complained to the Committee of the London Institute

> 'I understand that many members threatened to take their names out of the Institution and to induce their friends to do so, if ever I lectured again - that there was no general wish to hear discussions on political economy - and that I had better go elsewhere etc. etc.'[5]

Horton published both the discussion and the lectures in 1831, so that one can see just what content there was to some of the political economy taught in the Mechanics Institutes. He presented his purpose to the discussion group as 'impressing on your minds certain important and vital truths affecting the labouring classes and operating in all countries'. His opinions were not to relate 'to the policy of changing institutions, but

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1. See /Duppa/, A Manual for Mechanics Institutions, London, 1839, pp.196 - 229 for the content of the course. Brougham stated in an address of 1835 that his lectures on political economy were written by a friend 'whose name I am not at liberty to mention'. See address of Henry Lord Brougham to the Members of the Manchester Mechanics Institute, 21 July, 1835, pp.184 - 185
2. Minutes of the London Mechanics Institute, 1832. Also see R. Gilmour, 'The Gradgrind School of Political Economy', for Ellis' later career in popular political economy.
3. J. L. Dobson, 'The Contribution of Francis Place', p.363
4. See, however, Greville's comments. He attended the lectures at the Mechanics Institute with several other personages, and described them as well done and eloquent. Greville Memoirs, II, p.95, 23 Dec., 1830
5. Minutes of the London Mechanics Institute, 5 March, 1831, iii

to mere matters of fact'.[1] Horton lectured on the determinants of wages, emigration, distribution of income, taxation, skill and machinery. In a way suitable to his view of the Mechanics Institutes he stressed the superiority of the skilled labourer who had claim to two types of wage - the wage of manual labour and the wage of skill. The skilled labourer had a qualified monopoly in the area of the second type of wage, and was more immune from pressures on wages. His lecture on machinery typically called attention to the agricultural labourer and he drew heavily on Senior's view of the issue.

Many of the other speakers to the Mechanics Institutes spoke of political economy in the context of concern over machine breaking. Heywood spoke several times to the Manchester Mechanics Institute of advances in technology and the errors behind the destruction of machinery.[2] The Newcastle Institute heard lectures, in May, 1825 and again in May 1826 'on the utility of machinery, in promoting the comfort and happiness of the working classes of society'.[3] Baines lectured to the Leeds Mechanics Institute on machine breaking and foreign competition, and Marshall saw one of the advantages of the Mechanics Institutes as subduing popular errors in trade, wages and machinery.[4] Birkbeck lectured at the London Institute on the employment of machinery in 1831.[5] Place, as always, was very clear about the social meaning of the movement.

> 'The Mechanics Institute is one, if not the most important of our institutions. The better sort of working people

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1. Correspondence between the Right Hon. R. Wilmot Horton and a Select Class of the Members of the London Mechanics Institution', London, 1830, p.8
2. Place Papers, B. M. Add. Ms.27824 f 123 and B. Heywood, 'Second Address', p.30 - 31
3. Second Annual Report of the Literary, Scientific and Mechanical Institution of Newcastle upon Tyne, Newcastle upon Tyne, 1826; Third Annual Report, Newcastle upon Tyne, 1827.
4. Lectures by Edward Baines, September to November, 1830, Baines Papers. John Marshall to Brougham, 1826, Brougham Papers.
5. Minutes of the London Mechanics Institute, 1831

> have received a portion of instruction and whether this can be described as either good or bad it cannot be undone ... if the people had remained in their former ignorance, the burnings now so rife among the farmers would be as rife among the manufacturers. The knowledge obtained by the manufacturing people in the North has led many to the conviction of the fact that machinery is not and has not been their enemy'.[1]

The Mechanics Institutes were not the only outlets for lectures and pamphlets on the benefits of technical progress. Soon after the Mechanics Institute movement caught hold, energy went into the formation of the Society for the Diffusion of Useful Knowledge, for the publication of cheap editions and pamphlets. One of the early efforts of the Society was to respond to the threat of the riots. The Society attempted to reprint an abridged version of Cobbett's letter to the Luddites of 1816. Here Cobbett had defended the use of machinery and explained distress by taxation, the debt, and the church.[2] Cobbett would not allow an abridged version so the Society printed Brougham's quickly written 'An Address to the Labourers on the Subject of Destroying Machinery'. This was soon followed by Charles Knight's longer but not so popular tracts, 'The Rights of Industry', and 'The Results of Machinery'. But even more interesting was the popular writing of established political economists such as Richard Whately. He combined his clerical duties with propagating his views on political economy by publishing 'A Letter to his Parishioners on the Disturbances which have Lately Occurred', 1830, and his 'Village Conversations in Hard Times', 1831. These tracts pointed out the fallacies of destroying machinery of equal division of property, and of ascribing low wages to high rents and tithes.[3] Whately continued his work on political economy for children and the poor in an

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1. J. L. Dobson, 'The Contribution of Francis Place', p.389
2. This was the same pamphlet criticized in 1822 by Ricardo for its views on machinery.
3. R. K. Webb, The British Working Class Reader, pp.109 - 110

anonymous series in the Saturday Magazine in 1833.[1]

As J. F. C. Harrison has shown, popular political economy proliferated in the provincial institutes. Many provincial patrons collected tracts, promoted classes, or like John Marshall lectured and wrote the necessary material themselves.[2]

The Mechanics Institute Movement, during its heyday of the 1820's fitted into the improvement ideology of political economy. As I have shown in previous chapters, labour and the innovating artisan were regarded as integral to the process of technical change and economic growth. I have also shown that from within this framework of political economy emerged new programmes for the progress of wealth which were contingent on the discipline of the labour force. This concern with discipline and with industry in its dual meaning pervaded the Mechanics Institute Movement itself, and was reinforced by the Political economy taught there. The terminology of science, however, was very important to the movement. The emotive meaning behind concepts such as 'the arts', 'inventive', 'ingenious', 'experiment', and 'improvement' acted as a camouflage of a central concern with class dominance. This became increasingly apparent as the movement changed over the 1830's and early 1840's.

New Programmes and Social Change

A slump in the movement was followed by a resurgence in the 1830's and another in the 1840's. With this, however, came concern over membership and programmes. Fears over middle class infiltration into the membership went as far back as 1826. Concern mounted that the aspirations of middle

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1. See R. Whately to Miss Crabtree, 7 Jan, 1833, printed in E. Jane Whately, The Life and Correspondence of Archbishop Whately, D.D., London, 1866, i, p.180
2. See J. F. C. Harrison, Learning and Living, pp.80 - 82
   John Marshall lectured the first session of the Leeds Institute on the 'True Principles and Mutual Relations of Population and Wages', and wrote The Economy of Social Life.

class founders to appeal to factory operatives and mechanics had not been fulfilled.[1]

The concern to maintain a popular following also lay behind a shift in aims from that of creating a class of inventive artisans to that of creating an atmosphere of temperance, rational entertainment and industrious virtue. These latter aims, of course, had always been assumed by middle class patrons, and it would be wrong to see this as a sharp shift from technology to entertainment. In the London Institute subjects from the arts such as history, French, eloquence and clerical skills such as stenography accounted for at least one quarter of lectures over the 1820's. In the 1830's these subjects gained, accounting for half the lectures and classes given. Science and technology, however, retained a strong position in a greatly expanded lecture programme.[2]

Provincial leaders, at least, took pains to justify some change in orientation. Edward Baines justified entertainment in the Leeds Mechanics Institute as a way to greater understanding between social classes. The conditions of social peace, like science, would be conducive to industry.[3] Baines put this into practice by giving a series of lectures on his travels in Europe. He received support from John Marshall who, in 1830 complained that 'the sanguine predictions of the probable enlargement of science are ... trite and out of date'.[4] Heywood, too, produced a programme for more

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1. See B. Heywood, 'Eighth Address', 25 Feb., 1836, pp.85 - 86; and Samuel Smiles' report to the Select Committee on Public Libraries, 1849, pp.124 - 128
   E. Royle's complaint that clerks were more poorly paid than many artisans, and thus should not be regarded as working class misses this point. See E. Royle, 'Mechanics Institutes', 309 - 314
2. This assessment is based on an analysis of lecture topics discussed in the Minutes of the London Mechanics Institute for the period 1824 to 1839.
3. Leeds Public Library, Baines Papers, Edward Baines, 'On the Spirit of the Student and the Combination of Amusement with Study in Mechanics Institutions'.
4. Cited in J. F. C. Harrison, Learning and Living, p.66

entertaining lectures. He argued for more entertaining education which would give the working classes the desire for improvement. He was

> 'anxious for an altered system of instruction, not merely that we may give it more variety and interest, but that we may combine it with moral improvement'.[1]

The middle class was encouraged to accept the value of class contact, conciliation and co-operation. The Leeds Institute avoided topics at issue between middle and working classes.[2] The Newcastle Institute was proud that it had 'opened its doors to every description of persons desirous of mental improvement'.

> 'accordingly, we see in our rooms, mixed together, the modest and ingenious apprentice with the experienced and respectable tradesman. This generous mixture must produce the happiest effects, by separating youth from the insidious temptations of vice, and affording incitements to improvement and virtue'.[3]

Heywood complained of the 'lack of personal contact and kindly feeling between classes. He sought ways of breaking down this barrier, through provident or visiting societies.[4] Heywood in 1833 envisaged close connections between the Mechanics Institute and the newly formed Statistical Society, which he would have preferred to have called a political economy club. He was well aware of problems of class conflict and saw his own role as one of mediating this conflict. He spoke of the 'benefits of his own circumstances' in not being in any occupation which mixed him up in 'disputes between masters

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1. B. Heywood, 'Third Address', 11 Oct., 1830, p.37. He reiterated his new aims to Brougham in 1838, writing that his 'hobby now is to make Mechanics Institutes places of entertainment'. Brougham Papers, 1838.
2. R. J. Morris, 'Voluntary Organizations of Leeds', pp.330 - 337. See Dereck Fraser, 'Edward Baines' in P. Hollis, Pressure from Without, for a discussion of Edward Baines' gradual move towards class conciliation. His early opposition to universal suffrage was based on what he regarded as the short sighted commercial views of workingmen 'advocating restrictions in industry and exchange under the idea of protection, opposing machinery and all improvement, calling for a minimum of wages, condemming competition etc.'
3. Third Annual Report of the Literary, Scientific, and Mechanical Institution of Newcastle upon Tyne, Newcastle, 1827.
4. R. J. Morris, 'Voluntary Organisations of Leeds', pp.330 - 337

and workpeople' and therefore 'less subject to the imputation of interested motives'.[1]

The Mechanics Institutes changed, too, because they faced the growing strength of indigenous working class and socialist science societies. This phenomenon was recognized as a challenge to the movement. The Manchester Mechanics Institute, in fact, underwent a certain amount of democratization in response to the creation of the New Mechanics Institute in 1829. Rowland Detrosier opened the new institute which was to provide a radical combination of science and social science.

> 'Give to the mechanic that knowledge which enables him to outvie the workmanship of every other country, and of what moment is it to him, if the greatest portion of those means for which he has toiled ... are taken from him by the operations of a vicious government'.[2]

Wealth was not to 'exclude us from the temple of science', but equally the working man 'must grapple with the questions relating to capital, population, supply and demand; he must study not only the creation, but the distribution of wealth'.[3]

These demands also had the backing of a popular political economy, a political economy conceived of from the standpoint of the working classes.[4] Thomas Hodgskin continued his association with the London Mechanics Institute but lectured there on 'the natural science of national wealth', despite Francis Place's objections.[5] Hodgskin's conceptions of the movement were

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1. B. Heywood to H. Brougham, 30 October, 1833, Brougham Papers.
2. Rowland Detrosier, An Address Delivered at the New Mechanics Institution, December 30, 1829, Manchester, 1829, p.15
3. R. Detrosier, The Benefits of General Knowledge more especially the Sciences of Mineralogy, Geology, Botany and Entomology in an Address delivered at the Opening of the Banksian Society, Manchester, 5 January, 1829, p.14; An Address on the Advantages of the Intended Mechanics' Hall of Science delivered at the New Mechanics Institute, Manchester, 1831, p.4; also see his An Address Delivered to the Members of the New Mechanics Institute on the Necessity of an Extension of Moral and Political Instruction among the Working Classes, Manchester, 1831.
4. Elie Halévy, Thomas Hodgskin, Paris, 1903, p.89
5. B. M. Add. Mss.27823 f 369 , Francis Place to George Birkbeck, Place Papers.

published in his anonymous 'Labour Defended Against the Claims of Capital'.

> 'The Mechanics Institutes will teach men the moral as well as the physical sciences. They will excite a disposition to probe all things to the bottom and to supply the means of carrying the research into every branch of knowledge. [The Labourers] may care nothing about the curious researches of the geologist or the elaborate classifications of the botanist, but they will assuredly ascertain why they of all classes of society have been involved in poverty and distress'.[1]

He lectured the institute in 1826 on Malthusian population theory and the 'progress of knowledge'. He claimed a contingency between population growth and technical change, or what he called 'a knowledge of the wealth creating arts'.[2] He extended Smith's discussion of the division of labour to study the impact of greater knowledge in productive power. The division of labour in Hodgskin's system was not the source of the degeneration of work, but the source of potential benefit.

> 'Why the <u>labourers</u> actively reap no benefit from division of labour, why their tasks seem rather to augment than lessen, with all those improvements which add to their skill and productive power, in such a degree even as to have given rise to an opinion, that the division of labour inflicts on them a serious injury ... as all the advantages from division of labour naturally centre in, and naturally belong to the labourers, if they are deprived of them, and in the progress of society those only are enriched by their improved skill who never labour, - this must arise from unjust appropriations; from usurpation and plunder in the party enriched, and from consenting submission in the party impoverished'.[3]

But Hodgskin also viewed fixed capital as embodied labour, so that the knowledge and skill of the labourer who both made and used the machine became fixed in the machine.

> 'The enlightened skill of the different classes of workmen alluded to, comes to be substituted in the

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1. T. Hodgskin, <u>Labour Defended Against the Claims of Capital</u>.
2. London Mechanics Institute 'Political Economy', July, 1826, Place Papers (Add. Ms.27824 f 11p.) These lectures were later published as <u>Popular Political Economy</u> (1827).
3. T. Hodgskin, <u>Popular Political Economy</u>, London, 1827, pp.108 - 109

> natural progress of society for less skilful labour; and this enlightened skill produces an almost infinitely greater quantity of useful commodities, than the rude labour it has gradually displaced ... the productive power of this skill is attributed to its visible products, the instruments, the mere owners of which, who neither make nor use them, imagine themselves to be very productive persons'.[1]

The division of labour and the introduction of machinery were neither to be stopped nor tempered in Hodgskin's systems. Rather, since skill had been transferred to the machine, the worker had a right to the ownership of the physical embodiment of his skill.

Thomas Coates, in 1839 urged the Mechanics Institutes Movement to recognize this challenge and to move into the teaching of religion and politics. He pointed out that the socialists and chartists included in the plan of their societies some of the most attractive subjects of the Mechanics Institutes - that they gave lectures not only on science, but also on politics and music, and that they frequently held tea parties and dancing. Not only were the science lecturers in these societies the best that even the Mechanics Institutes could get, but they did have a much wider appeal than the institutes.[2]

Philanthropy and entertainment became the key note of the Institutes. Patrons came to see the Institute as an adjunct of their new social appointment, the statistical movement. This movement provided a suitable mix of philanthropy and political economy. Patrons, furthermore, came to recognize the permanence of classes lower than those aimed for by the Mechanics Institutes. A new pastime was the formation of Lyceums. These were to be as cheap as possible, and to offer recreation and elementary education. Manchester's was founded in 1838, and was followed by those in Miles Platting,

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1. T. Hodgskin, Popular Political Economy, London, 1827, p.251
2. Thomas Coates, State of Literary, Scientific, Mechanics Institutes, p.29

Salford, Ancoats, and Chorlton on Medlock.[1]

Certain exclusive scientific societies had long affirmed the position of the provincial and industrial middle class elites. Middle class patronage of working class societies, such as the Mechanics Institutes, was also fundamentally based on this motivation. Provincial philosophical societies took on new energy in the years following the initial upsurges of the Mechanics Institute Movement. The experience of the Mechanics Institute Movement as a national movement based on provincial grass roots support provided the background for a singular scientific movement in the 1830's. The 'Decline of Science Movement' and the formation of the British Association for the Advancement of Science preached the connections between science and industry, and the rescue of provincial scientific culture from its former oblivion.

National Science, Technology and the Middle Classes

The stimulus for these movements came from both the provincial and industrial interests and from metropolitan scientists and the Cambridge Inductivist circle. Lyell, in 1826 noticed the growing taste for science, and dubbed it 'characteristic of the present state of the public mind'. He commended the science societies for 'elevating and directing to nobler objects those provincial partialities and prepossessions ... to diffuse amongst the higher and middling classes a taste for liberal studies, and a spirit of philosophical investigation'.[2] By 1830, there was a fervent debate over the 'decline of science' and its implications. Babbage complained of the decline of interest in the abstract sciences, of the lack of endowments and honours given to science, of the use of political patronage

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1. See M. Tylecote, Mechanics Institutes, pp.53 - 66. But note that Oldham's Lyceum was predominantly petty-bourgeois. See John Foster, Class Struggle in the Industrial Revolution, p.167
2. /Charles Lyell/, 'Scientific Institutions', Quarterly Review, xxxiv, Sept., 1826, pp.153 and 173

in the allocation of university and government posts, and of the dilettante condition of the Royal Society.[1] His main supporter, David Brewster, traced the gloomy implications of this,

> 'In this rivalry of skill, England alone has hesitated to take a part ... she seems to have looked with contempt on the less dazzling achievements of her philosophers, and, confiding in her past pre-eminence in the arts, to have calculated too securely on their permanence. Bribed by foreign gold, or flattered by foreign courtesy, her artisans have quitted her service - her machinery has been exported to distant markets - the inventions of her philosophers, slighted at home, have been eagerly introduced abroad - her scientific institutions have been discouraged and even abolished - the articles which she supplied to other states have been gradually manufactured by themselves; and, one after another, many of the best arts of England have been transferred to other nations'.[2]

There ensued an intense debate among scientists over the reality of this situation.[3] The 'decline of science' was something of a misnomer for the debate which ensued. For this was a reflection, not of the decline, but of the vitality of science, informally organized and diffused through provincial culture. Babbage and Brewster could complain of the backward state of science precisely because of the growing interest in science. In an age of 'non-intervention' they could claim a special place for government support in 'research and development'. The appeal to the 'decline of science' in England was, in effect, a rhetorical gesture, and the very fact

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1. Charles Babbage, Reflections on the Decline of Science in England, London, 1830, Chapter 6.
2. /David Brewster/, 'Decline of Science in England', Quarterly Review, xliii, October, 1830, p.305
3. On this debate see Nathan Reingold, 'Babbage and Moll on the State of Science in Great Britain: A Note on a Document', British Journal of the History of Science, June, 1968, p.62; G. A. Foote, 'The Place of Science in the British Reform Movement 1830 - 1850', Isis, XLII, 1957, p.199; Roy M. MacLeod, 'Resources of Science in Victorian England', in P. Mathias, ed., Science and Society 1600 - 1900, Cambridge, 1972; D. S. L. Cardwell, The Organization of Science in England, p.106; J. M. Lubbock to Charles Babbage, 3 April, 1830, Babbage Papers, B. M. Ms.37185 f 139; William Henry to Charles Babbage, May, 1830, Babbage Papers, B. M. Ms.37185 f 179

of Babbage's and Brewster's agitation confirmed Lyell's assessment of a 'growing taste for science.' The British Association may have received its first stimulus from 'the decline of science movement', but what translated the association into a viable project from its first inception was the life of provincial science, particularly the energy of the Yorkshire Philosophical Society.[1]

The British Association was an itinerant society set up to meet once a year for a week in a different city. Its object was to 'make the cultivators of science acquainted with each other, to stimulate one another to new exertions, to bring the objects of science more before the public view'.[2] But the Association was set off from other provincial and metropolitan scientific societies by its role in bringing separate science societies together. Vernon Harcourt stressed at the first meeting that

> 'the object of this system is not only to give connection to the efforts of insulated inquirers, but to link Societies themselves together in a unity of purpose, and in a common participation and division of labour'.[3]

The ongoing nature of the Association was to be maintained by Whewell's suggestion of progress reports on the state of each branch of science.[4]

The inductivist framework of the critique of Ricardo as well as the empiricist approach of the Mechanics Institute Movement combined to define the social project of the British Association. The British Association, too sought to extend the realm of science from theorists to the practical man.

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1. The recent debate on the forces behind the founding of the British Association is in A. D. Orange, 'The Origins of the British Association', British Journal of the History of Science, December, 1972; Walter F. Cannon, 'History in Depth: the Early Victorian Period', History of Science, 1964; and J. B. Morrell, 'Individualism and the Structure of British Science in 1830', Historical Studies in the Physical Sciences, iii, 1971, p.202
2. A. D. Orange, 'Origins ... ', p.153
3. Reports of the British Association for the Advancement of Science, i, No.1, p.10
4. Whewell to Harcourt, September 1, 1831 in Todhunter, ii, pp.126 - 127

It saw itself as drawing into the realm of science the unknown provincial scientist and amateur. Harcourt's opening address discussed the unsettled state of the sciences, especially geology where even the lowest of generalizations were not settled. It was necessary that facts be gathered; and there was great need for an increased number of observers. Harcourt argued that those willing to take up the tasks would be 'men not incapable of surveying with accuracy a limited district, though they may not pretend to draw the general outline of a map, or fill up the whole of its details'.[1] And Murchison saw himself as fulfilling one of the essential aims of the Association when he reported the findings to the Association of one such amateur.

> 'I found that a poor hardworking druggist of Preston, Lancashire, who had made some years ago a very important observation on the existence of shells of existing species in the gravels and marls of Lancashire at 300 feet above the sea, and at distances of 15 and 20 miles from the sea, was present. I took the opportunity of turning lecturer, and having visited these parts this summer, I brought out my little druggist with all the éclat he merited. This is another practical exemplification of the good arising from such a reunion'.[2]

The aim was not only to involve the practical man, but to give science itself a practical basis. The key connection in the origins of the Association between the decline of science movement and the provincial societies was technology. A major focus of the Association was to give effect to the relationship between science and technology at something more than a rhetorical level. Babbage attempted to take credit for any success in this. He argued forcefully that the meetings be held in manufacturing towns with the object of bringing theoretical science into contact with the practical arts.

'I was, myself, particularly anxious for this, owing as I

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1. Reports of the British Association, i, 30
2. Archibald Geikie, Life of Sir Roderick Murchison, London, 1875, p.189

> do a debt of gratitude for the valuable information which I have received in many of the manufacturing districts, where I have learned to appreciate still more highly than before, the value of those speculative pursuits which we follow in our academical labours'.[1]

Babbage also claimed credit for another scheme which he saw as solving a fundamental defect in the Association. He thought the basis of the Association was limited, that it provided little to interest landed gentry or manufacturer. He saw the solution in the adoption in 1838 of his plan for an exhibition of the specimens of various manufactured and commercial products of the districts successively visited by the Association.[2]

Whewell, in his address to the third meeting of the Association managed to combine his plea for greater support to theoretical science with his memorable tribute to technology:

> 'Still, it would little become us here to be unjust to practical science. Practice has always been the origin and stimulus of theory: Art has ever been the mother of science ... there are no subjects in which we can look more hopefully to an advance in sound theoretical views, than those in which the demands of practice make men willing to experiment on an expensive scale'.[3]

And Professor Daubeny, at the 1836 meeting stressed the usefulness of the various abstract sciences to the chemical manufacturer, the miner and the agriculturalist.[4]

The direct confrontation of science and technology was established at the 1836 meeting when a special Mechanics section was added. Nearly £500 was allocated for the first year of special British Association research into the Cornish steam engines, into the strength of cast iron and into railroad and steam boat research. And the first committee of the Section included an eminent cast of engineers: Babbage, Charles Donkin, John Robinson,

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1. Reports of the British Association, i, No.2, 1832, p.107
2. Charles Babbage, Passages, p.432
3. Reports of the British Association, ii, 1833, xxv
4. ibid., v, 1836, xxxiv - xxxv

George Stephenson, Fairbairn, Professor Willis, and George Rennie.[1] This Section G became one of the most active of the Association. Most of the papers presented in the first years were concerned with aspects of the steam engine, the railroad, and fuel saving. By 1840 there were so many papers and abstracts passed on to the Section that assessment of main interests is difficult. Fairbairn presented several papers to the Section, and several more to the Manchester Literary and Philosophical Society on practical technical problems. He produced one in 1837 'On the Strength and other Properties of Cast Iron obtained from Hot and Cold Blast', and one for the 1844 meeting of the British Association 'On the Consumption of Fuel and the Prevention of Smoke'.[2]

The British Association, as well as fulfilling those attributes of middle class science in utility and social status, also provided rational entertainment. The Association does not seem to have made up its mind as to the professional or popular orientation of its meetings. The professional aspect was emphasized in its membership. Only those who were members of a provincial or London scientific society could join, and only those who had contributed to proceedings of any such society could sit on committees.

The Association was, however, also known for the great welcomes it received in each city it visited. The soirées at the annual meetings were the social event of the season for any city visited. Whewell, prior to taking up the Presidency in 1841, expressed irritation over these 'scenes of display'.[3]

It was at the second meeting of the Association in Oxford in 1832 that the society was moulded into its basic form. Murchison recollected of this

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1. Reports of the British Association, vi, 1837, xxi
2. W. Pole, ed., Life of William Fairbairn, London, 1877, Appendix.
3. Isaac Todhunter, William Whewell, ii, p.286 - 287, Whewell to Murchison, 18 Sept., 1840.

meeting: 'The mass of the great guns of the metropolis had now joined us ... also Sedgwick, Whewell and the best men of Cambridge. Our success was assured'.[1] The sciences were split into five sections each with its own committee. Mathematics and physics went to Section A; Philosophical Instruments and Mechanical Arts to Section B; Natural History to Section C; Botany, Zoology and Geology to Section D; and Anatomy and Physics to Section E. Section F - Statistics was added in 1833; and Section G - Mechanics in 1836.[2]

The energy in the British Association was, in a very important sense, a result of the provincial scientific societies. It was founded to recognize and bring together such societies. While the metropolitan institutions and universities slept or did other things, a new scientific movement had been overtaking the north and the midlands. It was, as Roy Porter puts it, 'an enormous energy for science, for statistics, for avid local factual inquiry of a kind not previously common in Eighteenth Century England'.[3]

The provincial societies, too, reflected the whole spectrum of interests shown in the British Association - intellectual science for its own sake, science as useful to industry, and science as rational entertainment.[4] There is little evidence that the societies became dominated by neutral scientific pursuits which mirrored political conservatism.[5] The Manchester Society along with the Leeds Phil. and Lit. included a proportion of topics on politics

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1. Archibald Geikie, Sir Roderick Murchison, p.204
2. Reports of the British Association, i, 1833, xxxvii
3. Roy Porter, 'The Industrial Revolution and the Rise of the Science of Geology', M. Teich and R. Young, Changing Perspectives, p.340
4. A British Association survey of 1840 reported on 112 institutions with a total income of £37,000. See Arthur Ryland, 'Income of Scientific and Literary Societies', Jrl. of the London Statistical Society, iv, October, 1841, pp.264 - 267. The Manchester Statistical Society in 1835 reported on ten major literary and scientific societies in the town, Appendix, the Minutes, Manchester Statistical Society, 11 Feb., 1835, Manchester Public Library.
5. See V. A. C. Gattrell's case for this, pp.172 and 193

and economics.[1] The Newcastle Phil. and Lit. kept its broad spectrum of interests in commerce, coal mining, agriculture, and the condition of the poor. Its Philosophical Institution ran courses into the 1830's on geology, chemistry, astronomy, political economy, the steam engine, and phrenology.[2] Furthermore, the representative sciences at many of the Societies were not the pure sciences of mathematics, physics, and chemistry, but the more popular geology, meteorology, and natural history. These interests branched into physiology, anthropology, and phrenology. This is quite clear in the Manchester, Leeds, and Newcastle Societies. Even the more intellectually based York Philosophical Society showed greatest interest in the geology and mineralogy of Yorkshire, antiquarian and archaeological topics, and meteorology and natural history.[3]

Political Economy and Scientific Philanthropy: The Statistical Movement

Despite all the rhetoric of the British Association, it does seem questionable whether many of the provincial Lit. and Phils. did very much to further the cause of the relationship between science and technology. The Manchester Society ranked quite high with five papers on mechanics in its 1831 Memoirs.[4] Both the Newcastle Lit. and Phil. and the Geological Society of Cornwall had been specifically set up to encourage co-operation between men of science and men in the mining industry. But this was the early project of the Newcastle Society, founded in 1793. By the late 1830's

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1. See Memoirs of the Manchester Literary and Philosophical Society, (2nd series), i - iv, 1800 - 1831. John Kennedy gave several papers on commerce, machinery and the poor. Transactions of the Phil. and Lit. of Leeds, i, Part I, 1837, pp.iii - xxii. The dominant subjects were the polite arts, antiquaries, and the various branches of anthropology.
2. Robert Spence Watson, The History of the Literary and Philosophical Society of Newcastle upon Tyne, 1793 - 1896, London, 1897, pp.35 - 39, 140, 208 - 234
3. A. D. Orange, Philosophers and Provincials, p.28
4. Memoirs of the Manchester Lit. and Phil. Society, (2nd series), iv

the Society was dying.[1] The Cornwall Society set up in 1814 with Davies Gilbert as President[2] achieved a successful fusion of geology and mining in its papers, and the local social identification of cultural gentry and mine adventurers.[3]

Science as rational entertainment was remembered by most of the societies which included topics on popular science, such as phrenology, and sought out scientific lecturers who illustrated their lectures with spectacular experiments and demonstrations.[4] The Leeds and Worcester Phil. and Lit. Societies, and the Pottery Philosophical Society made this a specific aim.[5] The popular content of these upper middle class societies probably increased in the late 1830's as had that of the Mechanics Institutes. There was a definite attempt to maintain a falling membership by such activities as planning museums or running evening conversation meetings. Many of the major societies - the Manchester and Newcastle and Phil. Societies, the Pottery and the Yorkshire Philosophical Societies, and the Leeds Phil. and Lit. were all either moribund or in serious membership difficulties by the late 1830's.

The situation of the British Association and the provincial scientific societies was also reflected in their statistical branches. The momentous

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1. Robert Spence Watson, Lit and Phil. of Newcastle, p.169
2. A. Hume, The Learned Societies and Printing Clubs of the U.K., London, 1853, p.142
3. Roy Porter, 'The Science of Geology', 328 - 330
4. See, for example, Sadler's lecture to the Newcastle Phil. and Lit. 'On the History, Theory and Practice of Aerostatics; in which will be explained the methods of constructing and inflating Montgolfier and inflammable balloons, illustrated by models which will be made to ascend in the lecture room'. Robert Spence Watson, Lit. and Phil. of Newcastle, pp.208 - 234
5. See E. Kitson Clarke, The History of 100 Years of the Leeds Phil. and Lit. Society, Leeds, 1924, p.9. On the Worcester Society see The Analyst, p.300, and Richard Jones' comment, 'The Worcester Association is only a large vent for the people's passion'. Jones to Whewell, 30 October, 1844, Whewell Papers, Add. Mss. c 52 (95) Trinity College, Cambridge. Stephen Shapin, 'The Pottery Philosophical Society', p.324

statistical movement of the 1830's grew out of both political economy and science. The movement was initiated both by government economic policy and by the ubiquitous circle of Cambridge whigs known for their leadership in scientific and inductivist circles. The membership of the burgeoning provincial societies drew on the same groups as the literary and philosophical societies and the patrons of the mechanics institutes. The statistics societies represented the blending of particular types of culture and philanthropy of both prior middle class interests. Like both these movements, too, the statistics societies were part of the practice of a progressive improvement-orientated political economy, which met the needs and ideals of commercial men.

At the outset, statistics was a bridge between the world of science and technology and that of political economy and commerce. The break between these two realms was not as clear cut as Francis Place thought in 1840,

> 'Here many will tell you they have no time to give the association to help the repeal of the corn laws while the simple fact is that ... four-fifths of the whole do nothing but lose their ... time ... Professional men they are called - a numerous body, artists of every description, members of scientific, Botanical and Linnaean societies. Teachers, parsons, and prelates of every denomination ... never become members or in any way assist to promote public political matters. With very few exceptions, they are meanly, slavishly inclined to leave things as they are'.[1]

Statistics during this period had become one of the tools of economic analysis. The Statistical Department of the Board of Trade set up by C. Poulett Thomson and directed from within the whig-liberal intelligentsia by G. R. Porter affirmed the doctrines of British economic progress and

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1. /B. M. Add. Ms.3515 f 233 (Place Papers)/ Francis Place to Richard Cobden, 4 March, 1840.

laissez-faire.[1] This statistical armoury was embellished by G. R. Porter's Progress of the Nation, J. R. McCulloch's, Statistics of the British Empire, and Commercial Dictionary, and McGregor's Statistics of Nations. The effect of all this on policy, however, is doubtful. Lucy Brown argues there was no sign that the government in 1839 and 1842 had a firmer knowledge of the economic situation of provincial areas than it had ten years before. Major sources of information on conditions remained individual businessmen such as the Gotts and John Marshall.[2]

This trend in policy was parallelled by statistical swing in political economy itself. Indeed, the Statistics Section brought many economists into the British Association. Economists, before the actual formation of Section F in 1833, had shown interest in the more systematic collection of data.

John Sinclair drew up the plan for his Code of Political Economy to indicate how his statistics would 'lay the best foundations of all useful improvements', and bypass the failings of political economy which 'by vainly attempting to do good to all, may do infinite mischief to particular nations'.[3] Sinclair argued in the Outline of his Code that political economists had neglected to ascertain the internal structure of those communities whose situation they proposed to examine. He felt that, though he had completed the massive Statistical Account of Scotland, the ultimate

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1. An account of the growth of government statistics can be found in Lucy Brown, The Board of Trade and the Free Trade Movement, Oxford, 1958, pp.76 - 94, and in M. J. Cullen, The Statistical Movement in Early Victorian Britain, N.Y., 1975, pp.19 - 74
   A typical example of the doctrinaire approach of this work is Bowring's 'Report on the Commerce and Manufactures of Switzerland'; Porter had been a member of the S.D.U.K. and was well known, prior to his appointment, to the whig-liberal circles dominating parliamentary inquiries in the 1830's. M. J. Cullen, Statistical Movement, p.21
2. Lucy Brown, The Board of Trade, p.88
3. Sir John Sinclair, Analysis of the Statistical Account of Scotland with a general view of the History of that Country and discussions on some important branches of Political Economy, Edinburgh, 1831, p.226

object of his research was not yet accomplished. His real goal was to 'found a system of political economy on a minute and extensive investigation of the local facts'. The chapters of his Code indicate the statist's conception of a broader political economy. The first three chapters were to cover population, individual incomes and their sources, and the nature of national wealth. The last two chapters were to be on the nature of a political community and the 'means of improving the happiness of individuals and the prosperity of a state'.[1] J. B. Say had long promoted statistical investigations.[2] Nassau Senior suggested, in 1831 a society for the improvement and diffusion of political economy - 'a society not for the discussion of theoretical and controversial writing, but a society for the collection of facts and observations ... a legitimate and proper pursuit which has been too long neglected'.[3] Bentham himself suggested a Statistics Society in 1831. Plans and support for a Statistics Society after the suggestion of a Statistics Section within the British Association came soon after from Thomas Chalmers, G. R. Porter, Poulett Thomson, J. D. Hume, Charles Knight and Chadwick.[4]

The Statistics Section was finally set up by the Cambridge Inductivists, Jones, Babbage, and J. E. Drinkwater, with Malthus and Quetelet at the first meetings.[5] Both the Statistics Section and the newly formed London Society soon included as its economists, Malthus, Jones, Babbage, McCulloch, Senior,

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1. John Sinclair, A Code of Political Economy, founded on the Basis of Statistical Enquiries, Sketch of the Introduction and Chapter I, Edinburgh, 1821.
2. J. B. Say, Treatise, i, 96
3. Mallet's Diaries, 3 June, 1831, Minutes of the Political Economy Club, vi, London, 1921, 227
4. M. J. Cullen, Statistical Movement, pp.86 - 87
5. The narrative of the formation of this section and the later London Society can be found in F. J. Mouat, 'History of the Statistical Society of London', in Jubilee Volume of the Statistical Society, London, 1885, p.15

John Sinclair, Thomas Tooke, G. P. Scrope and S. Jones Lloyd.[1] The first committee of Section F had Babbage for President and Drinkwater as Secretary, and included Malthus, Empson, Jones, and Quetelet. Later committees in 1834 and 1835 included Cleland, Whewell, John Sinclair, Dr. Chalmers, Professor Longfield, Leonard Horner, John Marshall, W. R. Greg, and W. Cooke Taylor.[2]

The inclusion of such a section within the British Association was controversial. Its inclusion within the constitution was based on the argument that science could be defined as all subjects capable of being reduced to measurement and calculation. Statistics would give the 'raw material to political economy and political philosophy', and 'lay the foundations of those sciences'. Rules of the section restricted inquiries to facts relating to communities of men, 'which are capable of being expressed by numbers, and which promised when sufficient to indicate general laws.'[3] The London Society defined its scope less narrowly. There were plans in this Society for a survey of social conditions in local areas. Fellows of the Society were to furnish suitable questions in the branch of knowledge of their interests. The questionnaire reflected the priorities of the Committee. Senior provided questions on the 'Labouring Classes', Jones on 'Rent', Whewell on 'Education and Literature', Porter on 'Crime, Savings Banks and Agriculture', J. E. Drinkwater on 'Machinery and Manufactures', and S. Jones Lloyd on 'Currency'.[4]

The Statistical Movement in its very being and rhetoric was conceived

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1. Annals of the Royal Statistical Society, London, 1934, pp.10 - 12
2. Reports of the British Association, ii, 1833, xl, 484; iii, 1834, xxx; iv, 1835, x
3. ibid., ii, 1833, xxviii, pp.5 and 6
4. ibid., ii, 1833, 484. Whewell kept a jealous watch on the scientific nature of the new section, complaining at intervals of the incursion of politics into the British Association. See Whewell to Murchison, 2 October, 1840 and Whewell to Northampton, 5 October, 1840 in Todhunter, William Whewell, ii, pp.291 and 293

of from the standpoint of the critique of political economy. The crisis of confidence within the theoretical circles of political economy reached out to the active citizens of the Statistical Movement. The Statistical Movement was regarded as an answer to the current lack of doctrinal agreement in political economy - 'the study of Statistics will, ere long, rescue Political Economy from all the uncertainty in which it is now enveloped'.[1] Statistics was to help to improve political economy and to set it upon a new scientific basis. It meant a new style which 'confronted' the figures of speech with the figures of arithmetic' and a mood of 'distrust of mere hypothetical theory and a priori assumption'. Statistics was also a new methodology, 'a general conviction that, in the business of social science, principles are valid for application only inasmuch as they are legitimate inductions from facts, accurately observed and methodically classified'.[2]

But the statistics societies themselves posed no threat to political economy. They did not go any further than to say they would go beyond political economy. In the main, they existed to 'bind up the wounds' of political economy, 'till lately a bye-word and a jest'.[3] James Kay of the Manchester Statistical Society spoke of statistics as exposing evils and poverty which derived not from the manufacturing system or laissez-faire, but from remote and accidental causes.

> 'In other words, improvements in machinery diminish the cost of production; but if demand for manufactures be limited by arbitrary enactments, the increased employment which would also be their natural and inevitable result, is prevented, until commerce is able in some other way to

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1. J. E. Portlock, 'An Address Explanatory of the Objects and Advantages of Statistical Enquiries', Statistical Association of Ulster, 18 May, 1838, printed in Journal of the London Statistical Society, i, No.5, Sept., 1838, p.317
2. 'Fourth Annual Report of the Council of the Statistical Society of London', Journal of the London Statistical Society, i, No.I, May, 1838, 8
3. William Augustus Guy, 'On the Value of the Numerical Method as Applied to Science, but especially to Physiology and Medicine', Journal of the London Statistical Society, ii, Feb., 1839, p.35

compensate for the evils of injudicious legislation'.[1]

Statistics was a necessary stage in political economy, if this political economy was to become a new inductive science. Observation without premature speculation was a necessary step towards truth.[2] Statistics was seen as reinforcing a new economics that was interested, not in radical explanations, or remedies for distress, but only in critiques of Ricardo. To statistics was attributed the finding that Ricardo was wrong to argue that poverty was a check to marriage, and wrong to argue that profits, rents, and wages moved in antagonistic directions.[3] The new menace was the urban horde breeding on poverty, and the new gospel was class harmony and integration.

The fulfilment of such integration, however, was to be based on the understanding of the moral effects of the environment. The London Society, and others which followed it investigated crime, education, religion, population, disease and poverty. The surveys and inquiries of the London Society over the years following have been adequately discussed by others.[4] The attempts to survey issues and questions such as these indicate the very broad base of contemporary interest in industrialization and political economy. For most of these issues were the dominant ideological concerns of political economy. Political economy had attached itself to the Mechanics Institutes Movement as a means of impressing on the working classes the benefits of industrialization, and political economy's idea of social and economic change. The Mechanics Institute Movement was covertly infused

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1. James Kay, The Moral and Physical Condition of the Working Classes Employed in the Cotton Manufacture in Manchester, London, 1832, p.57
2. Archibald Murchison's Address to the British Association. Reports of the British Association, vii, 1838, xl - xli
3. Address by Professor Lawson, 'On the Connexion between Statistical Enquiries and Political Economy' in Reports of the British Association, xii, 1843, (Notices and Abstracts), 94 - 95
4. See Eileen Yeo, Social Science and Social Change; M. J. Cullen, The Statistical Movement; and Phillip Abrams, The Origins of Sociology, 1834 - 1914, Chicago, 1968.

with political economy's image of industrialization, an image based on capital and a disciplined labour force. The Statistical Movement carried over this concern. In some cases the connection was a direct one. Benjamin Heywood, for example, referred to Manchester's new statistical society as a 'political economy club'. He identified the objects of this statistics society with the new trends of thought in the Mechanics Institute Movement, and with the effort to break down class barriers.[1] The statistical societies were a development of this feeling in the Mechanics Institute Movement. The study of the lives of the poor and their social problems was a way of showing concern. But, as Eileen Yeo has aptly pointed out, the surveys dealt with the world of home, church, school and disease, and not with the world of work. The statisticians, unlike the political economists, discussed the poor, but not the labourer. The statistics societies became another arm of political economy by effectively separating off the question of the social impact of industrialization from the issue of industrialization itself. Explanations for the condition of the poor were to be sought not in the economy, but in deficiencies in the institutions of socialization. This separation, in fact, operated to allow greater overall attention to one of political economy's primary concerns - a socialized, disciplined and efficient labour force. The middle class elite had, indeed, discovered the close connections between the social relations of production, and the religious, family and education institutions which reproduced these social relations.

Social Science in the Provinces

A large number of provincial societies followed fast on the London Society. The London Society stressed the cultivation of connections with the local societies and the encouragement of their multiplication, as the

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1. Brougham Papers, E. Heywood to H. Brougham, 30 Oct., 1833.

best support of its own efficiency.[1] Other societies, however, reflected similar interests and compositions to the regional scientific societies. Some such as the Manchester and Bristol societies were founded on philanthropic interests. Others emerged from within local scientific societies such as the Birmingham Philosophical Society and the Belfast Natural History Society.[2] The societies had a two-fold interest in industrial advance and social conditions. Most of the provincial societies did inquire into the state and development of various industries. Many of the societies made calculations on the increase of steam power in their areas. The Ulster, Liverpool and Bristol Societies all looked into the Anglo-Irish trade, and Glasgow assessed the trade between Ireland and Scotland.[3]

Most of the societies like the London one conducted surveys of the condition of the working classes, education, crime and population change. Philanthropy, for many, was a dilemma. On the one hand a scientific philanthropy, as opposed to indiscriminate charity could be based on a political economy whose terms had been broadened to the consideration of the whole of society. The relationships between statistics and philanthropy were turgidly outlined by William Hawkes Smith

> 'Their (the great bulk of the population) condition is ... far inferior to what it ought to be, speaking as philanthropists - what it might be speaking as statists ... These anticipations are now very generally entertained and these opinions indulged by the soundest and most reflective political economists'.[4]

Philanthropy had become a complex affair, even for those simply following

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1. Office of the Royal Statistical Society, London, London Statistical Society, Minute Book, p.16
2. This pattern was repeated by the Newcastle Society and the Leeds Society.
3. Journal of the London Statistical Society, 1838 - 1842, and Annals of the Royal Statistical Society, pp.72 - 76
4. The Analyst, A Journal of Science, Literature and the Fine Arts, London, 1834 - 1835, p.281

Christian ideals. The Bristol Society in 1839 complained,

> 'In a simple state of society, a man may know tolerably well what his duties to the poor are ... but what shall be said of the artificial and complicated state of things when a nation manufactures for half the world - when the consequence unavoidably is the enormous distance between the labourers and his virtual and subdivided employer'.[1]

The Movement's concerns with socialization and class harmony were clearly depicted in the provincial societies. Fear of social discontent and of the moral effects on the working classes of urbanization was formative in many of the societies. 'The preservation of public tranquillity' was haunted by 'the power of sans-culottism, a power overlooked and forgotten in periods of tranquility'.[2] A report in 1841 argued that the rich had taken the initiative in investigations which would contribute to 'strengthening the bond between classes', so that the labouring classes would 'cease to believe that there was no sympathy or solicitude from them in the higher ranks. Manchester's Society, indeed, was in one sense philanthropically devoted to 'cementing' together the different ranks and classes of society. In another sense, it helped to meet the 'need to provide a coherent justification of the factory system, at least in its more humane forms'.[3] The Society almost immediately constituted Samuel and W. R. Greg a committee to report on the evidence of the 1833 factory commission. Their evidence of 1834 vindicated the factory system and argued that the health of children improved when they entered the factory.[4] It also set up a committee to study the handloom weavers, and made plans for a digest of the Factory Inspectors' Reports.[5] It encouraged reports from its own members such as Samuel Greg

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1. Journal of the Bristol Statistical Society, 1839 quoted in Jrl. London Statistical Society, i, January, 1839, 549
2. ibid., 549
3. M. J. Cullen, Statistical Movement, p.107
4. V. A. C. Gattrell, pp.177 - 180
5. Theodore Gregory, 'The Early History of the Manchester Statistical Society', Transactions of the Manchester Statistical Society, 1925 - 26, pp.11 and 30

and Benjamin Heywood, who were involved in model factory villages. The model community was seen as the ideal form industrialization should take.[1] The reason was obvious, for such a community united the spheres of work and socialization. Modern industry could extend more rapidly with full control over its labour force - a control over skills, numbers and resistance. Manchester's first surveys were consciously directed away from employment conditions, particularly in the mills, and their focus turned to education and church attendance among the working classes. The use and provision of agencies for social discipline became a main preoccupation.[2]

The Manchester Society and most of the other provincial societies were primarily comprised of the reforming elites of the middle classes. Manchester's Society was, indeed, limited to those connected by class and family, and was dominated by cotton manufacturers and medical men. This was the same group which already dominated the Literary and Philosophical Society, the Provident Society, and the Mechanics Institute.[3] Most of the other societies had a similar composition. Many of these moved on in the late 1830's to surveys of the condition of the poor. Surveys of Glasgow, Nottingham and Miles

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1. See E. Yeo, 'Social Science and Social Change', pp.97 - 98
2. See Appendix to Minutes, Manchester Statistical Society where Poulett Thomson urged a survey of the poor, covering employment levels, distribution among the trades and wages. He urged consultation with manufacturers and inspection of their books as a source. Kay had this changed to a house to house survey on education and church attendance. See E. Yeo, Chapter IV
3. Manchester's society had a membership limit of fifty, confined to 'gentlemen accustomed for the most part to meet in private society, and whose habits and opinions are not uncongenial'. See Manchester Public Library, Draft Report to the Statistical Section of the British Association, in Appendix to the Minutes Manchester Statistical Society, September, 1834, No.19

Platting set out the massive poverty of the domestic outworkers.[1] The surveys of a particular group of workers conveniently focused on the remnants of a handicraft civilization. The weavers were a useful contrast to the better endowed factory workers. They were no threat to conceptions of ongoing industrial progress. The weavers were suitable cases for philanthropy and missionary activity, even a certain amount of public aid. The societies disconnected the poverty of such groups from the process of industrialization. This use for statistics was not what had been envisaged by John Sinclair. John Sinclair had attempted, in the outline for the first chapter of his Code of Political Economy to see the problem of population as a problem of employment. He saw technological unemployment as the source of much of the excess population. What he condemned here was not technical change per se, but the unexpected, sudden nature of the process of change. Sinclair demanded that the government intervene, and promote public works.[2]

Nor was statistical enquiry the sole preserve of the entrenched elites. There were cases, such as Sheffield's, where a leading light of the local statistical society could make radical use of statistics to challenge the factory system. George Calvert Holland, a Sheffield doctor, used a comprehensive set of statistics on earnings, population, crime, and mortality to support his views that 'degradation, poverty, and wretchedness were the inevitable effects of mechanization', and that the craft system was superior since 'the machine cheapens to the starving point the labour of the industrious mechanic.[3]

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1. See studies such as these: C. R. Baird, 'Observations on the Poorest Class of Operatives in Glasgow, in 1837', Jrl. of London Statistical Society, i, No.3, 1838; and William Felkin, 'Account of the Machine Wrought Hosiery Trade: Its Extent and the Condition of the Frame-work Knitters, read in the Statistical Section of the Second York Meeting of the British Association, 18 September, 1844, (2nd edition, London, 1845), p.39
2. John Sinclair, A Code of Political Economy, pp.33 - 34
3. G. C. Holland has been vividly resurrected by M. J. Cullen, Statistical Movement, pp.131 - 132. Also see C. V. Holland's journal of the early 1840's, The Millocrat, and his An Inquiry into the Moral, Social and Intellectual Condition of the Industrious Classes, London, 1839.

Most of the local societies collapsed in the early forties, or stopped their survey work. The Manchester and London Societies were the only ones to survive, and then only just. The London Society passed in 1840 to stressing the exertions of individuals to the strength of the society. The Manchester Society considered a motion in 1849 to dissolve because attendance over the past few years had been small and no committees were functioning.[1] Most of the societies died, like the Bristol Society, because they went into debt and failed to complete their massive and expensive surveys. They died too, because of a loss of strategic members. The societies failed because of their own intellectual limitations. Their surveys on the working classes had been thoroughly imbued with preconceived notions of the ills of society, and once sufficient propaganda had been gathered, there seemed little point in sustaining local research. The movement, above all, failed in its bid for control of the dominant value system. After the early 1840's, the period of mid-Victorian prosperity did not favour theories stressing the urgency of certain types of social reform. Philanthropy returned to the realm of religion, and political economy to economic analysis and laissez-faire.[2]

For a unique period in the 1820's and 1830's, a scientific movement had been the focus of visions of social reform and industrial progress among the entrenched middle classes. Political economy was the unifying discipline of the Mechanics Institute Movement. The close knit elites which patronized these movements found within them, for a time, a united programme of social reform and rational culture, utility and commercial advance.

The movements and interests within political economy were carried into

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1. London Statistical Society - Minute Book, p.86. See also T. R. Wilkinson, p.9
2. See M. J. Cullen, The Statistical Movement, pp.133 and 147, and R. M. Young, 'Malthus and the Evolutionists: A Common Context of Biological and Social Theory', Past and Present, No.43, 1969

the wider society by means of the close connections cultivated with popular science. A popular association between science and commerce was exploited and further cultivated by a political economy which explained and justified industrialization in terms of technical change. With this went a change in the nature and the control of work. The Mechanics Institute Movement, with its ideology of the innovative artisan, called for a labour force responsive to the developments of industry. The scientific movement provided deeper foundations for predictions in political economy of the phase of modern industry, based on science and the interaction of physical and not merely mechanical or human forces. Finally, the statistical movement both gave some empirical foundation to ideas on the significance of industrialization, and placed the question of the social impact of industrialization in a non-contradictory and complementary position in political economy's charter for the progress of wealth.

CHAPTER EIGHT

The Politics of Machinery

The unity between science and commerce which dominated the liberal middle class vision of improvement was reflected not only in ideas and in social identification, but also at the most concrete level - the level of policy. The debate on commercial and economic policy challenged the theorists both to apply and to develop their ideas. The policy debate, too, was an avenue for political action on the part of social groups. The policy debate was the conjuncture, the bringing together of all those complex spheres which went into the composition of an ideology. The policy debate clarified and even sharpened positions at the same time that it tempered argument to a tone of exchange and conciliation. For those who disagreed on many other issues, a policy debate was a challenge to choose between a very limited number of positions. In this sense, the policy debate blurred the heterogeneity of ideas and social identities, but equally, it demanded the radical disjuncture between one wide interest and another.

The policy debate also highlighted the key role of ideas in social practice. Ideas acted to translate the crude opinions of particular interest groups into a generalization of some theoretical conviction. Theory and systems of ideas played a definite part in the acceptability of argument, and in this way functioned as limits on the legitimacy of action. One must inquire into not only who benefited from the prevalence of certain ideas and policy, but also into those whom the argument was meant to convince.

The analysis of debate on economic policy will help to tell one more of the role of a particular set of intellectuals, the economists, and of the way in which political economy became integral to middle class identification. This chapter will draw out some of the parallels between areas of interest and discussion in both intellectual and policy debate. On the basis

of these parallels I will identify the common context of intellectual and policy debate on the machinery issue. I have chosen two debates, both of which involved extensive and two sided interaction with political economy, and both of which were primarily concerned with technical change.

The debates on the export of machinery and the emigration of artisans 1824 to 1841 have many features similar to those of the debates on the condition of the hand loom weavers 1834 to 1842, even if at first sight the two debates would be singled out for their contrasting nature. The first would appear to be a debate on trade policy with discussion focused on the sources of innovation. The latter would appear to be a controversy over social policy with interest focused on the social impact of technical change. These contrasting realms of economic policy very much reflect the uneasy balance of interests in middle class ideology. However, the common strands between two such different debates indicate something of the very limited boundaries of assumptions and preoccupations.

I will show in the pages following, just how these two debates formed a concrete picture of the theoretical discussion among political economists on the nature of technical change. Furthermore, I will show why it was that two such debates captured the attention of many political economists over this period.

The Export of Machinery

The debate on the export of machinery came into policy in the 1820's, then returned briefly in the early 1830's. The issue was not, however, forgotten in the interim years, and was frequently alluded to in other policy debates, and in the work of political economists. The debates were significant in these years for turning the public away from a narrowly confined and comfortable acceptance of the remarkable superiority of the British economy. The nature of this superiority came to be defined in

relative terms, as concern grew over continental industrialization and its challenge to Britain's technological lead. The controversy mobilized and divided industrialists and labourers in many parts of the country. The issue was of concern not only to representatives in Parliament, but to the arms of the bureaucracy in the Board of Trade, the Home Office, and Customs. Provincial elites, Chambers of Commerce, and manufacturing associations interacted from a new position of strength. The opinion of 'the manufacturing interests' was coming to express itself less through individuals, and more through combined fronts. Political economists were called upon to comment, and to demonstrate that the principles of free trade were also operational for the machine making industry. Machine making, as has been demonstrated by recent historians, was the pivot of the whole system of production.[1] Contemporaries, too, appear to have realized this. Free trade had always been conceived of in terms of free trade of manufactured commodities. The actual process of manufacturing had not been looked on as a market product in its own right. The debates reveal in a remarkable way, contemporary thought on skill, machinery, tools, and the process of invention. In addition, there was a clear change in the pattern of discussion on these issues between the first committee in 1824 - 25 and the second in 1841.[2]

Most of the restrictions against machinery were enacted between 1750 and 1785. They were roundly condemned by Adam Smith in his Wealth of Nations.[3] An extended narrative of the enactment of these restrictions and

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1. N. Rosenberg, 'Economic Development and the Transfer of Technology: Some Historical Perspectives', Technology and Culture, xi, 1970. Peter Mathias, 'Skills and the Diffusion of Innovations from Britain in the Eighteenth Century', Trans. Royal Hist. Soc., (5th series), xxv, 1975.
2. Select Committee on Combination Laws, Artisans and Machinery, Parl. Papers, 1824, v; Select Committee on the Export of Tools and Machinery, Parl. Papers, 1825, v; and Select Committee on the Export of Machinery, Parl. Papers, 1841, vii
3. Adam Smith, The Wealth of Nations, ii, pp.275 - 279

events leading up to their final repeal in 1844 has been given by A. E. Musson[1] from the point of view of the Manchester interest. On the actual detail of events, I will only add that all attempts at repeal of the legislation, except in the case of emigration, failed over this period until the final committee of 1841 - 1842. There was tremendous division over a set of laws almost universally recognized to be ineffective and practically inoperable.

The style of policy making in these decades along with the conflicts of private interests provide some context for a seemingly inexplicable dilemma. There has been serious revision of the view that the 1820's was a hey day of liberal toryism and free trade economics.[2] The export of machinery debates fit naturally into a style of economic policy which pragmatically accepted industrialization, and also made adaptable use of classical economic theory. Huskisson could invoke Ricardo on the issue and yet, a few years later, endorse a policy of countervailing duties 'which should be sufficient to place our commerce and manufactures in a state in which they could fairly compete' so as 'to excite his [the manufacturer's] emulation and his industry'.[3] This was part of a general attitude on the part of the 'liberal tories' of recognition of possible distress from foreign competition. It was common that some form of protection be left in place where industrial interests were strong enough to mobilize sufficient dissent.[4]

The expression of northern industrial interests in key policy issues was often random and arbitrary. Though Chambers of Commerce or commercial associations began to revive in the 1820's, they were not viable organs of opinion. Trade associations such as the London West India Company and individual industrial groups such as the cotton spinners had a more important

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1. A. E. Musson, 'The Manchester School and the Exportation of Machinery', Business History, January, 1972.
2. A. J. B. Hilton, 'The Economic Policies of the Tory Governments 1815 - 1830'
3. House of Commons Debates, Hansard (new series), xv, 18 April, 1826, p.349
4. Lucy Brown, The Board of Trade, p.14

political role.[1] Debates on economic policy affecting provincial areas, moreover, revealed great social and economic divisions within the manufacturing class itself. Conflicts between large and small capitalists and between various branches of the textile industry prevented unity in the opinion of the 'manufacturing interest'.[2]

The Committee on Artisans and Machinery also revealed an absence of strategic thinking and administrative capacity in the civil service. The Board of Trade had been in an obscure position and was only just beginning to emerge from this after Huskisson became president in 1823. The Board of Trade had little to do with the calling of this Committee and, indeed, participated minimally in the proceedings.[3]

The outcome of the 1824 - 1825 Committee was, however, to make provincial pressure groups and the Board of Trade much more important. The Committee recommended repeal of the Combination Laws and the laws against emigration, but it left intact the laws against the export of machinery, allowing discretionary power on the part of the Privy Council.

Decisions after the Committee had concluded, were left to the Board of Trade, and during the first period, most of these were taken by William Huskisson. Huskisson disliked this arbitrary power, primarily because he

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1. Lucy Brown, The Board of Trade and the Free Trade Movement, pp.182 - 185
2. V. A. C. Gattrell, 'The Commercial Middle Classes', pp.323 - 327; Arthur Redford, Manchester Merchants and Foreign Trade 1794 - 1858, Manchester, 1934, pp.127 - 129; cf. William Radcliffe, Origin of the New System of Manufacture, Stockport, 1828.
3. The only activities of the Board during the Committee were to send a directive to Customs asking for a detailed statement of the laws on machinery and artisans and a list of prosecutions. The Board was also fed information on the continental machine industry by Charles Ross and Richard Chenevix, who were functioning as industrial spies. P.R.O., Board of Trade Correspondence, B.T. 3 - 18, 15 April, 1824 and B.T. 1 - 195, 31 May, 1824. Also see /Richard Chenevix/, 'Comparative Skill and Industry of France and England', Edinburgh Review, xxxii, Oct., 1819, and 'History and Prospects of English Industry', Quarterly Review, xxxiv, Sept., 1826; and Charles Ross, 'Artisans and Machinery', Quarterly Review, xxxi, March, 1825.

had no theoretical criteria for licensing and prohibition. He based his discretion at various times on the amount of skilled labour embodied in a machine, on the expressed interests of groups of manufacturers, or on the 'present state of trade'. In 1841 it was reported that the criterion was none of these, but rather a distinction between preparatory and manufacturing processes.[1]

Manufacturing associations also became very active after the results of the first Committee. Commercial crisis in the north in 1826 - 27 prompted further debate on the issue. A flurry of memorials went to the Board of Trade, petitions were presented in Parliament, and a long exchange took place in the House of Commons. Memorials against the export of machinery arrived in the Board offices from the Manchester Chamber of Commerce, and from manufacturing associations in Leeds, York, Halifax, Bradford, Huddersfield, and Birmingham. The Manchester Chamber of Commerce discussed the issue at length in November, 1826 and sent a deputation to the Board of Trade to ask for stricter enforcement of the laws against the export of machinery.[2] Hume presented two petitions from Manchester machine makers on 5 May, 1826 arguing that the restrictions on the export of machinery exacerbated their distress and unemployment. Contrary petitions were presented by Huskisson and Littleton in the exchange in the House that took place on 6 December, 1826. This exchange involved a long debate on the matter between Hume, Huskisson, Warburton, Parnell, Bright, Peel and Colonel Torrens.[3]

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1. Huskisson complained of his powers many times. 'Speech', 14 June, 1825, Speeches of the Rt. Hon. William Huskisson, London, 1831, ii, 425; Hansard, 6 Dec., 1826, xvi, 293. For changes in licensing criteria see Hansard, xvi, 293; B.T. 5 - 35, Letter 19 July, 1826; B.T. 5 - 35, Letter 22 July, 1826; and Select Committee on the Export of Machinery, P.P. 1841, vii, Testimony of J. D. Hume, 11 - 15
2. Minute Book, The Manchester Chamber of Commerce, 8 Nov., 1826, 15 Nov. and 13 Dec., 1826.
3. See B.T. 5 - 36, 23 April, 1827 and 12 May, 1827; B.T. 5 - 35, 25 Nov., 1826; Speeches, Hansard, xvi, p.291 - 298; and 5 May, 1826, Hansard, xv, pp.908 - 911

The Manchester Chamber continued its vigilance and agitation, through till the end of the 1830's. It kept in close touch with other provincial chambers, with the Board of Trade, with the Comptroller of Customs, the Parliamentary representatives, and with the Chancellor of the Exchequer.[1]

There was little change in policy through the 1830's. Though the Board of Trade came to form a congenial framework for intellectuals of the free trade movement, initiative in lifting restrictions was not the hallmark of the Cabinets of the period. When, however, J. D. Hume, former Comptroller of Customs, and an active member of the Political Economy Club, moved to the Board of Trade, he did try to carry on the tradition of Huskisson. The next Select Committee on the Export of Machinery was not called until 1841, and the laws were not repealed until 1844.

Polemics and Prophecy

Debate on the export of machinery and the emigration of artisans was not only conducted in the form of the parliamentary speech, select committee, memorial and petition, but also in the London and provincial press and in the texts of political economists. The two select committees on the issue also reveal a definite shift in the terms of debate. In 1824, of primary concern was the course of overall industrial progress. By 1841, analysis went to the balance of a specific capital goods sector. In the debates of 1824 - 1825, there was very close consideration of the nature of technical change and the role of artisan skills. Techniques were conceived of as embodied in these skills, and machines, in turn, were regarded as adjuncts and embodiments of the 'artisan'.

A major problem area was the extent to which development was possible both at home and abroad, given the free availability of patent specifications, plans and models. Attention thus gathered not only on the generalization of

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1. See Minute Book, Manchester Chamber of Commerce, 1826 - 1830.

skill and the division of labour, but on the technical heritage and the cultural and economic milieu for the generation of innovation. By 1841, emphasis had changed to the problems of a capital goods sector. Commentators stressed the advance of the Belgian machine making industry, the significance of the tool industry, and the integrated nature of innovation between the textile industry and the engineering industry. This section will describe the various themes of discussion which went into these contrasting discourses.

It is first very striking to note the very significant parallels between the shift in the terms of discourse in this particular policy debate, and the shifts in theoretical political economy from an emphasis on labour productivity and skills to machine technology and capital. Even within this schematic division, however, there were many differences and ambiguities in the style of debate. These reveal the complex interplay of theory and policy. An attempt to follow the many twists and turns in the major themes of the debates will help to clarify and explain some of these interactions.

The first theme of discussion was justice and property rights. Justice was the subject of the debate over the emigration of artisans, and thus we find the debates on emigration fitting naturally into the discussion of the Combination Laws which were considered by the same Select Committee. The laws were subversive of the rights of individual property.[1] 'Liberal and not restrictive laws ... were the source of England's prosperity'.[2] The laws were also oppressive since they were actually operative only on the poorer tradesmen. Earlier in 1821, this was the reaction to the indictment of several artisans attempting to leave the country.

> 'If a labourer or artisan is thrown out of employment in his own immediate neighbourhood, he is to be deprived of parish support; if to avoid starvation, he seeks work in any other district, he is to be seized as a vagabond and

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1. J. R. McCulloch, Editorial in the Scotsman, August 16, 1823.
2. Leeds Mercury, 29 May, 1824, and Liverpool Mercury, 11 June, 1824.

> flogged, - and if he attempts to escape to other countries he is arrested by indictments and beggared by fines'.[1]

Some saw this not as oppression, but as an economic liability. The real loss was the middle class manufacturer or skilled mechanic who could and would leave.[2] The theme of justice and individual rights was clear in a representative correspondence in the Birmingham Chronicle which upheld the liberal principles of 'a mechanic' and the actions of the 'theoretical legislator' against the national interest of 'the manufacturer'.[3] The Morning Chronicle even added a note of conspiracy, but not the conspiracy of the smuggler or enticer. It carried the story that Manby's prosecution for enticing artisans abroad had been led by those who were trying to increase the price of iron to the consumer.[4] There were certain elements who argued that the mechanic's skills were not his own property. John Kennedy and the Manchester Chamber of Commerce claimed that the real inventor was the manufacturer. The machine maker was only his assistant.[5] The reply to this was that Kennedy had made a false distinction between machine maker and manufacturer with respect to the ownership of machinery.[6] The question of the ownership of skill, as I have shown, was central to the radical critique of political economy by Thomas Hodgskin. It was this issue, too, which later provoked some of the Drummond professors to claim the entire production process including ingenuity, invention and skill for the capitalist.

Among the labourers themselves, although the justice of free mobility

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1. 'Attempts of Artificers to Leave England', The Traveller, 20 April, 1821, Place Cuttings, xix, p.76
2. Thomas Robinson, A Treatise on the Injurious Effects of the Free Trade System and the Exportation of Machinery, Leeds, 1830, p.17
3. Birmingham Chronicle, 26 February, 1824, 4 March, 8 March, and 11 March, 1824.
4. Morning Chronicle, 26 February, 1824.
5. John Kennedy, On the Exportation of Machinery, Manchester, 1824, p.20 Manchester Chamber of Commerce, Minute Book, (8 November, 1826), pp.457 - 461
6. Manchester Guardian, 24 April, 1824.

was urged, opinion was divided as to the effect of emigration of members of the craft. Gravenor Henson, a Nottingham bobbin net lacemaker who was almost fanatically opposed to free emigration, argued it was a general opinion of the working classes that

> 'he (the emigrant craftsman) is only endeavouring to get away from misery; but doing that which will bring misery upon him and his trade, by taking the arts of his country to put bread into the mouths of foreigners ... it is only postponing his own misery by ruining his trade, which will affect him also in a foreign country'.[1]

A group of radical artisans, the Select Committee of Artisans of Great Britain, noted already for their early statistical efforts, also hoped both to prevent the export of machinery and the emigration of artisans, and to bring forward a tax on machinery. It referred to plans for free emigration as a 'mere theoretical conceit'.[2] And Richard Needham, a Bolton cotton weaver told the Committee of 1824 that he had been

> 'sent to state the opinion of a large body of weavers that if artizans were to leave the country, it would produce deplorable consequences. Since cotton twist had been exported, wages had fallen continually. If machinery were to be exported, wages would fall still further'.[3]

The discussion of the emigration of artisans continually returned to the question of justice, and the inheritant legitimacy of the removal of restrictions on labour. The emigration of artisans thus fell well within the terms of debate of the Combination Laws. Those who opposed emigration were not

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1. Henson's campaigns against the export of machinery and emigration of artisans is described in S. D. Chapman 'Introduction' to Henson's History of the Framework Knitters, (1831), (reprint London, 1970), p.xvii For more on Henson's role in this and other Parliamentary committees see Roy Church and S. D. Chapman, 'Gravenor Henson and the Making of the English Working Class', in Jones and Mingay, Land, Labour and Population during the Industrial Revolution, London, 1967.
2. Select Committee of the Artisans of Great Britain. Report at Bolton Public Meeting, 13 January, 1824.
3. Select Committee on Combination Laws, Artisans and Machinery, P.P.1824, v, Testimony of Gravenor Henson, 279

likely to win an argument by challenging the 'justice' of free mobility. They had to seek some other form of analysis to support their arguments. One answer was to shift the discussion of the role of artisan skills in technical change away from the artisan himself to the machine. Artisan skills were .... discussed in the rather different light of their relation to the development of and export of machinery. Political expediency thus channelled the discussion of skills through an intermediate analysis of machines.

One finds this expressed in analyses of continental competition. A characteristic argument was that foreigners were unable to make a machine from plans which 'led only to perplexity and confusion'. But if the machinery was available, 'they could make models of it and come at the principle at once'.[1] Others pointed out that such models were insufficient unless combined with a base of artisan skills. The distinctive characteristic of England was her milieu of enterprising mechanics and manufacturers ('themselves mechanics and inventors'), and her systematic division of labour.[2] Success in new techniques depended on the subdivision of many branches of an industry.[3] One commentator formulated the situation aptly when he argued that he who emigrated took the knowledge he had, but could not carry the principle of improvement and growth. 'Those left behind advanced' - he 'remained stationary'.[4] Much depended, however, on the institutional setting of these artisanal skills. The 'moral' or 'mental' capital given such great significance by Torrens and Senior was here analyzed into two components: the theoretical knowledge that went into skill and the practical 'know-how' acquired through experience.

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1. Thomas Robinson, A Treatise, p.17
2. P.P. 1824, v, Testimony of J. R. McCulloch, 596
3. P.P. 1824, v, Fairbairn's Testimony, 568
4. The Globe and Traveller, (December 7, 1826). It is likely that this correspondent was Robert Torrens.

There was also contemporary distinction between the London and the northern engineers. The London engineer viewed himself as more theoretical and more flexible than his less versatile, but more practical northern counterpart. John Kennedy, however, doused the distinction in sarcasm: 'machine makers as they are called in this country, but engineers as they style themselves in London'.[1] If the London engineers regarded themselves as more versatile, they were also confident about their sources of labour. They were able to tap the underemployed skills of London handicraftsmen. Henry Martineau reported:

> 'I have known instances where watch-makers and mathematical instrument makers have become extremely useful, and these are a description of workmen who do not receive a very high rate of wages in London, and of whom I could get a very considerable quantity, if required'.[2]

Both Martineau and Henry Maudslay also argued that the division of labour, better tools, and the greater number of goods produced would allow for the introduction of more common workmen and for a greater diversity of hands.[3] If there was a lack of skilled men, this was blamed on demand conditions which had discouraged the training up of apprentices. Galloway, for example, argued that he had been for several years 'negligent in taking apprentices, and creating proper nurseries for workmen'.[4]

The point was often raised in these debates that if machinery was freely exported, there would be little emigration of mechanics, and thus the very important artisan skills would not be lost to the continent. However, the concept of the machine repair man seemed an adequate answer from the opponents of repeal. The mechanic who repaired machinery was conceived of

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1. John Kennedy, On the Exportation of Machinery, p.20. For a discussion of the London and Lancashire engineers see the Report of the Select Committee on The Export of Tools and Machinery, P.P. 1825, v, 10 - 11
2. P.P. 1825, v, Martineau's Testimony, 21
3. P.P. 1825, v, 20 and 31
4. P.P. 1825, v, Galloway's Testimony, 39

as having much more general and more highly developed skill than those who worked on single processes in a machine factory.[1] John Kennedy and the memorial of the Manchester Chamber of Commerce elaborated on the process by which the machine repairman became the machine manufacturer.

> 'The exportation of machinery absolutely compels the foreign manufacturer to possess the means of becoming his own machine maker; and the more machines you send abroad, the greater number of mechanics become necessary to keep their parts in order. Hence again arises a demand for those tools which are necessary to mechanics, the mechanics with their tools are sure to be ultimately employed, not merely in repairing the existing machines, but in the making of new ones ... '[2]

The importance of the division of labour within the machine making industry had been brought into discussions of skill. As has been pointed out, the extent to which the division of labour was carried out determined the types of skill needed. The division of labour was seen to be one of the reasons why the production of textile machinery seemed to be the preserve of the northern manufacturers. Higher wages and costs dominated the London trade, with its concomitant less practical and less extensive division of labour.[3] Neither Maudslay nor Galloway could, however, find a great deal to praise in the Manchester methods. As Galloway put it:

> 'that division of labour is of great advantage in articles of great consumption; but while it makes cheap goods, it does not make general workmen; a too great division of labour circumscribes the power and intelligence of the workman, which is the great mischief of abstract employments; it makes men mere machines, and we find that the Manchester and other country workmen who are brought up to abstract employments, can do little else, and are inferior workmen until they have worked some years in a shop where general work is made'.[4]

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1. This was believed even as late as 1841. Peter Fairbairn argued that repairs 'required a more skilful man than I would employ in my own works; because in my works a subdivision of labour takes place; I require a good many very superior men, but I can do by subdividing the works with some inferior men'. P.P. 1841, vii, 211
2. John Kennedy, On the Exportation of Machinery, p.17
3. P.P. 1825, v, pp.40 and 41
4. P.P. 1825, v, Galloway's Testimony, p.41

It was this concept of the 'general workman', able to make the connections between his activities and to perceive the principles behind his toil, which was so important at this time to the rhetoric of the Mechanics Institute Movement.

As I have shown, those who opposed the emigration of artisans in the 1824 debates shifted the terms of debate about artisan skills from the artisan to machinery. Now, however, the political effect of the repeal of the laws on the emigration of artisans was to transfer the terms of debate on skill back to the artisan. The leadership for this change in language was now taken not by those opposed to repeal, but by those seeking the further repeal of the laws on the export of machinery. This was certainly the immediate reaction of those seeking licences for the export of their machinery.[1] It was also carried over to some extent, into debate on the export of machinery as late as 1841.[2]

Much earlier, in the 1824 - 1825 debates, some discussion was directed to the employment generating effects of machine making. Techniques were embodied in artisan skills. Machines, in turn, embodied these artisans.[3] Economists and certain policy makers fully recognized that much of the dispute was over the establishment of a new branch of industry. McCulloch and Hume condemned the laws for depriving Britain of 'an additional branch of manufacture'.[4] This was formulated more explicitly as early as 1825 by William Ellis, one of the philosophic radicals. He considered that the manufacture of machinery could become a staple industry itself.[5] Subsequently,

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1. See B.T. 1 - 96. Petition to Export Machinery from Alexander Galloway, 19 June, 1824; and P.P. 1825, v, p.37
2. P.P. 1841, vii, See Testimonies of Thomas Aston, Grenville Withers, Thomas Marsden and William Jenkinson, 22 - 23, 54, 89, and 105 - 106
3. P.P. 1824, v, Testimony of Phillip Taylor, 30 cf. 163; and P.P. 1824, v, McCulloch's Testimony, 592 - 593 and 598
4. P.P. 1824, v, McCulloch's Testimony, 596, and J. Hume, Speeches, 5 May, 1826 and 12 February, 1824, Hansard, xv, p.909, x, 145
5. William Ellis, 'The Export of Machinery', The Westminster Review, 1825.

Nassau Senior discussed the ease of transferring capital by decomposing it into its degree of 'manufacture' or 'fixedness'. The most easily transferred was 'mental capital' or 'knowledge and education'.[1] The ubiquitous Charles Babbage anticipated the development of science based techniques with the progressive expansion of this capital goods sector.[2]

The interest in the capital goods sector was founded on both fears of continental advance and the vision of new industrial expansion. The peril to the country was not to be measured by present competition, but by the 'magnitude of the preparations' and the 'germ of progress in the rapid increase of machine making establishments' abroad.[3]

It was not only skill or machines, but machine tools which were important in facilitating the diffusion of techniques. The discussion of tools became a major preoccupation for the 1841 Committee. It was an anomaly that neither steam engines nor tools were restricted from export. A petition from the Manchester machine makers in 1841 argued that these tools 'by supplying the deficiencies of inferior workmen' had 'surmounted the chief obstacles to machine making abroad'. But the tool industry was also an important contribution to the limitless possibilities of an English capital goods industry. England could become the machine centre for the world. It would offer foreigners the largest and most profitable markets for their inventions. 'From the skill of our artisans and the advance of our mechanical arts, their crude ideas would be most likely to be perfected and brought into operation'.[4]

The development of a separate capital goods sector brought with it important implications for the structure of the working classes. Mechanics

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1. Nassau Senior, Outlines of Political Economy, p.220
2. Charles Babbage, 'Introduction' to Peter Barlow, A Treatise on the Manufactures and Machinery of Great Britain, London, 1836, p.80
3. J. C. Symons, Arts and Artisans at Home and Abroad, Edinburgh, 1839, p.173
4. Committee of Machine Makers, Facts and Observations Illustrative of the Laws which Prohibit the Export of Machinery, (Manchester, 1841)

and engineers were to be important elements in an emerging labour 'aristocracy'. Charles Babbage envisaged this in 1836 when he linked the growth of this branch of industry with the class of mechanics who were more skilled and more highly paid than the class who used the machinery. The export of machinery would allow for the expansion of this 'higher and more valuable class'.[1] Some, like Torrens were less sympathetic to this class. When Parnell raised the usual complaint of the injustice of preventing mechanics from freely exercising their industry, Torrens replied in the Globe,

> 'but the machine makers having embarked in a branch of industry, subject at the time to certain restrictions, which have been rather relaxed than increased, they have no reason to complain when those restrictions are not entirely removed'.[2]

The controversy over the export of machinery acted, in ways similar to the rhetoric of the Mechanics Institute Movement, to promote a controlled and disciplined labour force formally divided into its skilled and unskilled sections. The new and 'higher class' of mechanics would defuse the threat posed by the 'mass' nature of the working class. The prospects for industry at home and the reasons for limited diffusion abroad of new techniques were reinforced by factors other than skilled labour and capital. The notion of a labour 'aristocracy' was connected with ideas of a systematic approach to production. The 'labour aristocrat' though accorded distinct status by industrialist and middle class reformer was still subject to the discipline of the labour force.

Organization, precision and discipline were fundamental to 'systematic' production. Babbage's key variable was the 'domestic economy of the factory.'[3]

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1. Charles Babbage, 'Introduction' to Peter Barlow, p.80
2. Place Collection of Newspaper Cuttings, lvii, p.15
3. Charles Babbage, On the Economy of Machinery and Manufactures, London, 1832, p.295

Fairbairn argued that the French were 'deficient' in the 'arrangements and method' of their factories and 'more confused in their operations'.[1] The French were 'less attentive to that economy of manual labour', and the English had special advantages in 'those economical arrangements - the results of practical experience which are of so much importance in the management of large concerns'.[2] Even as late as 1841, J. G. Marshall expressed his fears of allowing foreigners to look at 'the mode of using the machines'.[3]

The debate over the export of machinery and the emigration of artisans only takes on its special meaning in the context of the intellectual terms of analysis, and in relation to its economic and social situation. The object of the next section will be to define more closely these economic and social influences.

Cyclical Change and Allegiances

Among the major influences on this debate must be counted the economic conditions during 1824 - 1825, the commercial crisis of 1826, and the depression of 1841 - 1842. The major social influences were the interests of various groups represented in the course of debate, and represented in the practical implementation of policy.

An investment boom in the North in 1824 - 1825 operated to separate the interests of London and Northern engineers. Sudden increases in the demand for machinery affected only the Northern machine makers, and it was the northern mills that 'stood idle for want of machines'. William Fairbairn described the situation, 'I do not think in two, three, or four years hands can be trained to supply a greater quantity than is now in demand ... they

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1. P.P. 1824, v, Testimony of William Fairbairn, 568
2. Charles Ross, 'Artizans and Machinery', p.398; and 'Justitia', Manchester Guardian, (28 February, 1824).
3. P.P. 1841, vii, Testimony of J. G. Marshall, 195

would not be able to supply orders from the French'.[1]

The 1826 depression threatened both machine makers and manufacturers. The question, furthermore, became linked with that of the labourers rioting in Lancashire. The fears over social disorder and machine breaking were compounded with fears of foreign competition. Foreign competition was held up as the spectre to those who sought the elimination of distress in the destruction of machinery. It was this that Edward Baines, son of the editor of the Leeds Mercury, stressed in his Address to the Unemployed Workmen of Yorkshire and Lancashire. Francis Place and Archibald Prentice re-stated the fear in the Trades Newspaper and the Manchester Gazette.[2]

By 1841 - 1842 there was again another depression. Manufacturers no longer complained of a shortage of machinery, and at least one of the major witnesses to the Select Committee had changed his opinions on the export of machinery.[3] There was, however, no concerted mobilization of industrial opinion. Holland Hoole explained the apathy of the Manchester manufacturers and the Chamber of Commerce by the depressed trade conditions.

> 'the master manufacturers are almost desponding as regards the state of our trade, and the general expression of feeling is, that the legislature may do whatever they please, they cannot make things worse'.[4]

John Foster explains the apathy of the Manchester manufacturers as a 'loss of will to oppose changes which still cut across their basic interests.'[5]

Economic conditions did influence the expediency behind policy actions, and did influence the quantitative impact of certain arguments. But social

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1. P.P. 1824, v, 569 - 570
2. Francis Place, 'Breaking of Machinery and Breaking of the Corn Laws', Trades Newspaper, 7 May, 1826; and Archibald Prentice, series of leaders in the Manchester Gazette, April and May, 1826.
3. Thomas Ashton admitted changing his views with the new economic conditions. Second Report of the Select Committee on the Exportation of Machinery, P.P. 1841, vii, 22
4. ibid., p.52
5. John Foster, Class Struggle and the Industrial Revolution, London, 1974, pp.187 and 206

interests were at least as important. It was quite apparent to contemporary spectators that this issue was one of conflict between various interest groups. The Morning Chronicle, in introducing the issue, expected that those involved in metal work would want to have the laws removed, while those involved in manufactured goods would oppose repeal.[1] The issue was seen as very similar in nature to the celebrated Eighteenth Century debate over the export of cotton twist. 'Liberalis', a correspondent to the Manchester Guardian, compared the two issues and concluded that manufacturers again sought to protect their own interests against those of machine makers.[2] The old debate was also frequently invoked during the course of the 1824 Select Committee. At least one manufacturer, Peter Ewart, was hard put by to explain the difference between the two debates. He feebly argued that in exporting cotton yarns, one did not export the means of making them; forgetting that yarn was also the 'means of making piece goods'.[3]

The conflict of interests between manufacturers and engineers raised the question of the extent of the social and economic differentiation of the machine makers. The Nottingham lace and stocking trades were vertically integrated. There could be no conflict of interest simply because practically all manufacturers made their own machinery.[4] Lucy Brown has argued that the central conflict in these debates was between the interests of the machine makers and the interests of the spinners. And Redford argued that the debate witnessed an alliance of cotton spinners and merchants against a new class of machine makers. Musson, most recently, has argued that the real disagreement was between the country and the London engineers - that Manchester's representatives were a united front before the Commons

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1. Morning Chronicle, 17 February, 1824.
2. Manchester Guardian, 17 April, 1824.
3. P.P. 1824, v, 259
4. P.P. 1841, vii, William Felkin's Testimony, 141 - 143

Committee.[1] There thus appears to be little agreement among current commentators on the core of the dispute.

What is most striking about these debates is the very lack of clarity in the economic position and social composition of the opposing groups. If one looks at the engineers in Manchester, one finds some machine makers very closely tied in social composition to the manufacturers. Many carried on both trades, or had done so at some time.[2] Equally, the provincial engineers in this period were characterized by fragmentation. There were multiple groups within the machine making industry, and each followed his own trade. Throughout these years, they were seldom involved in local politics, and tended to act as a stabilizing force.[3] Oldham's engineers formed an autonomous craft elite. The Oldham engineers in this period, operated a local closed shop which supported other engineering unions which, together, guaranteed benefits and high wages.[4] In spite of this 'united front' from Manchester one finds Joseph Hume presenting petitions from Manchester machine makers in 1826 in opposition to petitions from Manchester manufacturers in the same year. In spite of the interests of spinner against machine maker, one finds both the Glasgow cotton spinners and John Marshall, the Leeds flax spinner divided in opinion.[5] One group of Staffordshire iron masters opposed repeal, and another supported it.[6] Birmingham small wares manufacturers as well as Norwich worsted manufacturers also opposed repeal.[7]

The case for repeal of the laws against the export of machinery was

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1. See Lucy Brown, The Board of Trade, pp.161 - 167; A. Redford, Manchester Merchants, p.131; and A. E. Musson, 'The Manchester School and the Exportation of Machinery', Business History, January, 1972.
2. Examples are Peter Ewart, John Kennedy, Henry Houldsworth, and Thomas Ashton.
3. V. A. C. Gattrell, pp.95 - 99
4. John Foster, Class Struggle, p.225
5. P.P. 1824, v, 380 - 381and 601
6. P.P. 1824, v, 126 and 129
7. P.P. 1824, v, 154 and 310 - 311

upheld by Committee members, by economists,[1] and by the liberal middle class press. It is also possible that repeal was not a pressing urgency at the time. Widespread smuggling networks were a non-legalized social convention, and were even institutionalized in manufacturing circles through various insurance arrangements. An even greater limit on the 'interests' behind this debate was the small extent to which these foreign exports were felt to be a problem by the northern manufacturers. Most had the impression that if machinery was in short supply, foreign orders were either not filled at all, or at least, had to wait until orders in the more secure home market were met. It, therefore, appears to be quite impossible to align dispute on the issue with defined social and economic interests. The definition of such interests must be arbitrary. The evidence we have of 'interests' is derived only from the position of those few groups who organized themselves to create the issue.

The only evidence that seems to exist of a politically organized and active lobbying group is that of a small group of Manchester manufacturers. This group can be defined by its actions - constant petitioning to Parliament and lobbying in the Board of Trade to enforce vigilance on the laws. Analysis of actual Board of Trade decisions reveals much more liberal licensing in 1825 and the first part of 1826 than at any other period up to 1835. The Board generally refused between twenty and thirty per cent of applications, and this proportion did not decline even though applications rose from fourteen in 1825 to one hundred and thirty-three in 1835. In 1825 licences were granted for printing blocks and flax spinning machinery. Serious consideration even went to a trade of five hundred mule jennies for five hundred French jacquard looms.[2]

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1. Torrens was the notable exception. Cf. Torrens, Letters on Commercial Policy, 1830.
2. B.T. 5 - 34 - 35 and P.R.O. Board of Trade, Machinery Book, 1827 - 1841.

Between April and July, 1826, a 'test case' emerged which resulted in stricter licensing on the grounds of 'manufacturing interests'. This test case was the licensing of the export to France of fifty cases of machines for preparing spinning cotton. The intervention of a group of interested manufacturers and a flurry of petitions led to such a tightening up of discretion that after 1826 all machines used in preparatory processes for the textile industry were refused. In addition refusals were now imposed much more rigorously on turning lathes, engraving machinery, machines for making bar iron, and other engineering tools.[1]

Empiricism and Policy

The debates on the export of machinery and the emigration of artisans represent something more than another example of that 'imperialism of free trade' which dominated the thinking of cotton men in this period, and right through until their overt endorsement of imperialism and protection in 1857. The debates have a much wider intellectual scope. This is to be found in the way this singular interest and the many other diverse economic interests I have noted were formulated in terms of a theoretical discussion on skill and the generation of a capital goods industry. Crude opinion became submerged on a platform which brought the enlightened provincial industrialist together with the metropolitan policy maker and economist. Witnesses to committees, writers of pamphlets, and local journalists participated in their own critical intellectual milieu. The rhetoric of their mechanics institutes, scientific societies, and statistical societies provided them with the cultural and intellectual tools for an intrinsic and often empirical criticism of strict classical political economy. They took pride in this culture which removed them from the sphere of the mere practical man, and yet prevented them from

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1. On the test case see B.T. 5 - 34 - 35 - 36, B.T. 5 - 35 Minutes' 19 July, 1826, p.155. On refusals to license, see B.T. 5 - 35 - 36 for 1827 and Machinery Book for 1828.

falling into the grip of doctrine. They saw themselves as the founders of a new critical spirit.

> 'Before political economy can have any pretensions to be classed among the sciences, it must be greatly simplified ... axioms must be laid down and rest on facts and experiment ... we naturally feel gratified to find that our ministers ... are at length "beginning at the right end", by instituting inquiries among experienced men, who can alone be competent to decide how practice squares with theory. We anticipate more benefit to the cause of truth and knowledge from such investigations as those now in progress in the Select Committee ... on artisans and machinery than from the writings of the whole tribe of jurists and political economists'.[1]

The image of the artisan inventor and the self-made entrepreneur featured in the schemes of economic progress of those mechanics institutes and popular industrial histories which captured the imagination of middle class members of factory towns. The Manchester factory was regarded as the natural companion of the London trades. The principles behind both were smoothed into one - the division of labour. Kennedy's idea of the origins of the cotton factory is an apt illustration.

> 'the division of labour and small improvements made by workers in hand implements continued till their cottages filled with little improvements ... and they were forced out of their dwellings by the multiplication of their implements ... here starts the factory system'.[2]

Both the London trade and the Manchester factory, however, came together to demand a novel investigation of the logic of free trade. An empirical view of the process of technical change led to ideas on the dynamic of economic progress, ideas much closer to everyday concerns than theoretical speculation on the international specialization of free trade. Adam Smith, a long time before this, had made the point that many inventions were piecemeal developments. 'The division of labour no doubt first gave occasion to the invention of

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1. Liverpool Mercury, 16 April, 1824.
2. John Kennedy, 'Observations on the Rise, & Progress of the Cotton Trade in Great Britain'.

machines', but furthermore,

> We have not, nor cannot have, any complete history of the invention of machines, because most of them are at first imperfect, and receive gradual improvements and increase of powers from those who use them'.[1]

Such ideas demanded closer investigation of the structure of capital, and the analysis of labour into its skilled and unskilled components. The logic of free trade was challenged to meet new sectoral and factor complexities. For the economically interested and intellectually aware industrialist, a policy debate like this one, was simply a different platform for a new unification of concerns which dominated his culture and practice in everyday life.

Such debates, however, were just as significant for political economy. I have shown the enduring preoccupation of political economists with the process of technical change in all its manifold aspects. A debate such as this one was a rare opportunity for learning. Many political economists at the time, and for years after, reflected on a debate which, it must be admitted, was of small political and economic significance when compared to the great corn law debates of the same period.

The debates were, for many, another opportunity to apply their ideas on free trade. For just as many others, however, the range of issues was tantalizing and stimulated them to extend and modify their theories of capital and skill. The debates were constantly used as a source of evidence to support these new ideas. Many economists, McCulloch, Senior, Scrope, Babbage, quoted freely from the evidence. McCulloch appealed to the debates to support his analysis of the impact of high wages.[2] Furthermore, he along with Malthus, was called on in a consultancy capacity by the Select Committee of 1824.[3]

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1. Adam Smith, Lectures quoted in N. Rosenberg, 'Adam Smith on the Division of Labour: Two Views or One', Economica, 1965, pp.129 and 132
2. J. R. McCulloch, Principles, 1825, pp.322 - 323
3. P.P. 1824, v, 592 and 598

Some, like Say, benefited from a post under Napoleon as inspector of foreign factories. Say regarded capital as incapable of restraint, but noted the advantages an immigrant artisan brought with him. He not only added to population, but brought an 'accession to the profits of national industry and an acquisition of capital'.[1] Others, like Torrens, were firmly entrenched from the beginning in their opposition to repeal of the restrictions. Place, in 1826, had sneered at Torrens talking 'like a silly old woman' about the advantages of preventing export of machinery.[2] Indeed, Torrens was introduced to the House by Baring in 1826, in the context of a debate on the export of machinery. Baring introduced the honourable member for Ipswich as an economist 'who yet dissented from the modern doctrine of political economy'.[3] Nassau Senior, too, in 1830 found cause to take up the issue and to justify, under certain circumstances, restrictions on the export of machinery.[4] John Stuart Mill, in the same year, found the export of machinery to be a possible source of disadvantage until all restrictions on trade were abolished. Until then, the export of machinery was a 'proper subject for adjustment with other nations, on the principle of reciprocity'.[5]

Machinery and the Handloom Weavers

A quite different debate on the handloom weavers also brought dissension among economists and industrialists. In many ways, however, the debates on the condition of the weavers were of a quite different order than those on

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1. J. B. Say, Treatise, ii, p.184
2. Graham Wallas, The Life of Francis Place, 1771 - 1854, London, 1898, p.179
3. House of Commons Debates, Hansard, xvi, 6 Dec., 1826, 296. Cf. Robert Torrens, Letters on Commercial Policy.
4. Nassau Senior, Three Lectures on the Cost of Obtaining Money and Some Effects of Private and Government Paper Money, London, 1830, p.26
5. John Stuart Mill, 'Of the Laws of Interchange Between Nations', Essays in Some Unsettled Questions, (1844), 2nd edition, London, 1874, p.32

the export of machinery. Within the very framework of economic and scientific advance, the weavers were a permanent and painful shadow. The first industrial revolution was an experience of excitement and prospects for many living through the rapid transformation. Yet never far from this was the consciousness of a massive and lingering case of technological unemployment. David Landes has put the situation of these years thus:

> 'The middle and upper classes were convinced by the marvellous inventions of science and technology ... that they were living in the best of all possible worlds ... For these Britons, science was the new revelation; and the Industrial Revolution was the proof and justification of the religion of progress. The 'labouring poor', especially those groups by-passed or squeezed by machine industry, said little but were undoubtedly of another mind'.[1]

The weavers, of course, had many parallels both in their own time and earlier years. But their case was seemingly one of unprecedented pervasiveness. While political economists and others compared them to previous cases of labour displacement, and spoke of labour mobility and the creation of new employment opportunities, the weavers of a generation lingered, unemployed. Such new jobs were for others, not for them. And while the weavers lingered on, they voiced an eloquent challenge to a freely developing industrialization. They themselves were the subject of Parliamentary inquiries, pamphlets, journals, newspapers, and economic tracts. Unlike the interests involved in the export of machinery and emigration of artisans, the weavers evoked consciousness and commitment. Their's was an ongoing, everyday struggle against mechanization. It was, indeed, a struggle characteristic of the workplace in most industries, craft or factory. The weaver, however, became the most apparent example of this struggle to keep control in the place of production. The most

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1. David Landes, The Unbound Prometheus, Cambridge, 1972, p.123

outstanding feature of this ongoing struggle against mechanization, a struggle based also on skill, the organization of production, and the discipline and pace of work, was the constant and pressing fear of technological unemployment.

This debate, though such a contrast to my first debate particularly in ideological and political overtones, showed certain common features with it. The first feature, of course, was a common concern with technology, a concern with its generation and the inevitability of its diffusion. The second was that the weavers, like many provincial manufacturers, regarded their major enemy to be doctrinal political economy, and the cold logic of free trade. Like the provincial manufacturers, they also gathered allies from unlikely circles. Several political economists, local and national middle class politicians, magistrates, and manufacturers came to their support. The ideological significance of an optimistic political economy and a scientific culture cannot be underestimated as key to the dominant middle class vision of these years. Yet it is important to remember that not all whig radical politicians and millowners fitted the picture of the 'liberal canting millowners'.

At the basic economic level, most cotton masters took a conservative, or at least cautious attitude to the introduction of the power loom. The power loom took forty years to become the representative method of weaving. Such attitudes are easily explained by the range and number of purely economic constraints on the diffusion of this new technique.[1] Many millowners, outside of their purely economic interests, had traditional views of community and religious feeling, or even radical political views which took them beyond the realm of their class interest. Indeed, the way the weavers conducted

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1. See Maxine Berg, 'The Introduction and Diffusion of the Power Loom, 1789 - 1842', M.A. Thesis, Sussex, 1972.

their agitation showed that they realized this. Perhaps to their own detriment, they never renounced their 'respectable masters'.

The debates on the weavers also form a convenient comparison to the debates on the export of machinery. A parliamentary agitation was organized in both cases at least twice during the twenties and thirties. There was an agitation in the early 1830's culminating in the Select Committee Reports of 1834 - 1835. Another agitation resulted in a full scale Royal Commission, started in 1837, but not reporting until 1841. The weavers appearing as witnesses at these committees were nearly all appointed delegates of weaving associations or weaving localities. They had a background in radical politics or long years of petitioning and they made use of their sympathetic intermediaries in the middle classes. Most had some knowledge of the language of their opponents, acquired in places like the Mechanics Institutes, as well as a consciousness of their own aims and culture. Their language of negotiation in these debates reflected the process of translation. The issues raised were ones common to debates within political economy: overproduction, taxation, speculation and competition, the efficiency of machinery, and unemployment. Others have sketched the details of the weavers' labour market, industrial organization and politics. Here I will say something only of the historical foundations of the weavers' struggle against machinery.[1]

Wage cutting took place from the earliest days of this period. The first demand of the weavers from 1790 onwards was for a legal minimum wage, and distress was spoken of even earlier. Thomas Barnes, an early liberal dissenter, for example, also addressed himself to the weavers when he denounced the destruction of early spinning machinery:

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1. See E. P. Thompson, The Making of the English Working Class, chap. 9 and Duncan Bythell, The Handloom Weavers, A Study in the English Cotton Industry During the Industrial Revolution, Cambridge, 1969.

> 'What mean those riotings and tumults, which we saw a few months ago? What mean the petitions to parliament, to suppress or tax the machines? The wisdom of Parliament will not certainly regard such petitions'.[1]

Barnes elaborated on the benefit of innovation in the language of his unitarian faith in progress. He identified, however, with the interests of the poor and stressed the key role of the artisan labourer. His understanding of the dread of innovation in his time, however, did not deter him from emphasizing the impact of this innovation on family incomes. Looms had 'improved continually in simplicity, usefulness, and conveniency', especially 'the stocking loom at Nottingham and the Dutch or swivel loom at Manchester'. The new spinning machinery had increased the incomes of females: 'if it is true that the weaver gets less, the wife gets more, and the family does not suffer'.[2]

The woollen weavers were speaking of their decline as early as 1803 and calling for a stop to the factory system in spinning.

> 'Coarse and middling cloth has undeniably become a most miserable occupation. No men living perhaps toil so hard and reap so little benefit as the clothiers of the present day. But they know no other business, nor have they capitals to turn to any other; they must therefore struggle on. Wanting the aid of their sons as early as their strength will allow, they are all very generally also doomed to the same fate, and must become cloth weavers or workers in their turn'.[3]

The militancy of the weavers increased, particularly under the expansion of factory weaving in the 1820's. This expansion proceeded in the 1820's and 1830's along with a sub-contract network, acting in effect as a type of 'symbiotic exploitation of labour'. This system allowed the manufacturer to set up his steady trade on the produce of power loom sheds, and to use

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1. Thomas Barnes, Thoughts on the Use of Machines in the Cotton Manufacture Addressed to the Working People in that Manufacture ... by a Friend of the Poor, Manchester, 1780, p.19
2. ibid., pp.7 - 8 and 14
3. Anon., Observations on Woollen Machinery, Leeds, 1803, p.16

handloom weavers as a response to fluctuations. In good years they could be employed without any higher fixed cost to the manufacturer. In bad years they could be cast off.[1] Extensive publicity was given to the riots among the Blackburn and Burnley weavers in 1826.[2] There were more riots in the Manchester area in 1829. The year 1831 wasanother time of distress among the weavers.[3] The weavers met, but now showed disapproval of disturbances among the southern agricultural areas. Papers such as the Blackburn Gazette found the time convenient to run a series on the 'Advantages of Machinery'.[4] The Bolton Chronicle compared the far away 1831 agricultural riots with the local riots of 1826.[5]

Riots, however, gave way to two types of organization generated in the 1820's. In the cotton industry, there were those who sought an alliance with the big capitalists against the small. They saw the source of their distress in the 'grinder's system'. As William Longson, the Stockport weaver argued ad nauseam.

> 'The grinding system owes its existence to a comparatively small number of employers ... "Those who undersell the well disposed masters by underpaying the workman's labour" ... There is in the trade such a number of well disposed masters, as forms a decided majority, and want nothing but a legal sanction ... to enable them to abolish the grinding system ... '[6]

The Bolton Weavers' Committee conducted a correspondence with Huskisson,

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1. David Landes, The Unbound Prometheus, pp.118 - 119 describes the interactions between factory work and outwork. Also see Maxine Berg, 'The Introduction of the Power Loom', pp.46 - 54 for specific instances of how this was carried out in the weaving sector.
2. Detailed reporting on these riots can be found in the Blackburn Mail, 3 May, 1826, the Leeds Mercury, 6 May, 1826, the Manchester Gazette, 29 April and 6 May, 1826, and the Manchester Guardian, 31 March, 1826.
3. Archibald Prentice, Historical Sketches and Personal Recollections of Manchester 1792 - 1832, Manchester, 1851, pp.343 - 347
4. The Blackburn Gazette, 26 Jan. and 2 Feb., 1831.
5. Bolton Chronicle, 26 Feb., 1831.
6. William Longson, An Appeal to The Masters, Workmen, and the Public Shewing the Cause of Distress of the Labouring Classes, Manchester, 1827. Also see his many letters to the editor in the Bolton Chronicle, 1827 - 1829.

calling for boards of trade to fix a legal minimum wage. Huskisson's only reply was:

> 'Their plan involves ... calling in the aid of that authority, to check the progress of those improvements, in mechanical and chemical science, by which manual labour is so often abridged and superseded'.[1]

A debate on the advantages of the power loom and the machinery in general featured in the northern papers over the course of this year. Francis Place's well known letters on machinery were relayed along with much bitter reply through the pages of the Bolton Chronicle.[2] Pathetically, some of the weavers wrote to Peel, of a new epoch in manufactures:

> 'while every new discovery in the art of reducing manual labour, tends only to enrich those by whom the improvement was introduced and to prevent an equal proportion of poverty among the working classes, we cannot refrain from protesting against such innovations'.[3]

At the other pole were those who called for unionization. The Quilting Weavers' Association gave clearest expression to the difficulties of unorganized labour:

> 'our masters ... still refuse to make any additions to the price of our labour ... The name of the weaver is become almost synonomous with that of the vagrant ... The "poor weavers" are not allowed to occupy a place in decent society ... Under all these circumstances the necessity of forming ourselves into a strong union for the purpose of removing these pressing evils, must be evident to every thinking mind'.[4]

This polarization allowed for two types of reaction by the middle and upper classes. On the one hand, tory radicals and humane employers could identify

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1. Blackburn Mail, 13 September, 1826; Bolton Chronicle, 30 September, 1826.
2. See Place Collection of Newspaper Cuttings, lvii. The relevant issues of the Bolton Chronicle no longer exist. For discussion on the power loom see Manchester Guardian, 31 March, 1826, Manchester Gazette, 1 July, 1826, Blackburn Mail, 12 April, 1826, Leeds Mercury, 6 May, 1826, Blackburn Mail, 12 April, 26 July and 23 August, 1826.
3. 'The Weavers Address', from the Weavers Union Society to Peel, Blackburn Mail, 12 April, 1826.
4. The Webb Papers, xxxvii, 'Cotton Weavers', pp.31 - 32. The Manchester Weavers' Association of 1824 also voices appeals to uphold the union.

the weavers' cause with the attack on factory abuses.[1] On the other hand mill owners organized to resist the weavers' unions.[2]

Agitation and Alliances in the 1830's

The weavers' agitation of the 1830's continued the grievances and national petitioning that had become traditional to the trade. A new political context did, however, change the formal expression and politics of these demands. The language and personnel of the vanguard in the handloom weaver debates now merged with the Ten Hours Movement. This movement was a confused assortment of tories, working class radicals, and humanitarian liberals. In the factory movement and the handloom weaver debates, Oastler, Sadler and Bull, were all evangelical tories. Fielden, the radical, co-operated with E. S. Cayley, another Yorkshire tory, and John Maxwell, the whig representative for Lanarkshire. The Cobbetts and Owen were also able to count on Fielden's alliance. The radical agitation among weavers and factory workers was indeed partly built up on the ruthlessly opportunistic use by workers of any avenue or platform open to them to air their grievances. The politics of their allies was irrelevant. The working classes sought to use the platforms and political power of any sympathetic M.P. or millowner as a medium for their own claims.

Tory allies, at least, became enthusiastic supporters of working class grievances, which gave them another way of expressing their own deep seated emotional values. The abuses of industrialism were drawn out in lurid detail by Sadler, Shaftesbury, Oastler and the Rev. G. S. Bull. Within the factory movement, an older tory paternalism became combined with a

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1. For example, the woollen manufacturers and merchants of the Forest of Rossendale met in 1823 to demand protection for manual labour and a tax on the produce of the power loom. See Anon., Observations on the Use of Power Looms by a Friend to the Poor, Rossendale, 1823.
2. S. J. Chapman, 'An Historical Sketch of the Masters' Associations in the Cotton Industry', Jrl. of the Manchester Statistical Society, 13 Feb., 1901, p.69

disappointed romanticism. Oastler's romantic toryism brought him to advocate industrial and agricultural protection, taxation of machinery, and measures to reduce unemployment. This economic policy was united with tory views of the family. The family based domestic industry of the weavers was regarded as the best school of moral virtue. The impact of the introduction of machinery on the male labour market was, furthermore, regarded as unnatural and dilution through an unprecedented sexual division of labour was keenly felt. One public meeting in Oldham denounced the abuse of machinery, which had 'taken employment out of the hands of men and put it in those of women, whose province is in the house and home'.[1]

There were many personal links between the Ten Hours Movement and the handloom weavers debates. The number of reform leaders over the various movements of the 1830's was small. Such middle class leaders as came to the fore had a cultural ancestry in tory paternalism and in the service and good works of liberal dissent. When John Maxwell made his motion for a bill on the condition of the weavers in 1835, he had the active and long involved support of many northern M.P.'s, many of them from manufacturing families. John Fielden for Oldham, W. Bolling, Robert Torrens, and Ainsworth for Bolton, Hesketh Fleetwood for Preston, and Joseph Brotherton for Salford all agitated for the weavers both nationally and locally.[2]

Issues were also common to both movements. The involvement of tory radicals did not prevent great popular support in an agitation which was at root a struggle over the length and control of the working day. Factory hands and domestic workers found their fundamental unity in the terms of struggle within the workplace. Reformers in Bradford proclaimed that the Ten Hours Legislation and taxation of machinery must be obtained together.[3]

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1. Report of a Public Meeting in Oldham on Factories, Oldham, 1836, p.25
2. Bolton Chronicle, 15 August, 1835.
3. J. T. Ward, The Factory Movement, 1830 - 1855, London, 1962, p.125

A broadside from Bradford, in fact, called for a check to the competition of machinery by a 'direct tax' on its use or by an 'indirect tax' on the period of using it.

> 'Unrestrained machinery must ere long be the ruin of the Country. Restrain it then. Time it and tax it both. Cry out aloud for a Ten Hour Bill and a Tax upon Machinery, or we shall soon all be ruined together!'1

It was, in fact, during the official inquiry into the demands of the Ten Hours Movement that Oastler drew up the details and gave publicity to John Sadler's new 'pendulum loom', hoping this more efficient handloom would enable the weaver to compete with the power driven factory.[2] Oastler gave evidence to the 1834 Committee, and Bull and Oastler both helped the Bradford weavers with their pamphleteering.[3] The Spitalfield weavers asked Oastler's friend William Atkinson to represent them, and he wrote a tract on their behalf.[4] In 1835, G. S. Bull's Cause of Industry appealed for support in alleviating the 'misery of the industrious human machines' by restricting machinery.

> 'The small Manufacturers or Employers of Handloom Weavers are the only remaining hope of this community - they form a link between labour and independence'.5

Both reformers in the Ten Hours Movement and those in the handweavers debates conceived their major enemy to be the rhetoric of political economy. Hesketh Fleetwood, though supporting the weavers advised them that they would have little chance of success.

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1. Unrestrained Machinery must Ere Long be the Ruin of the Country, Bradford Broadside, 1834.
2. J. H. Sadler, The New Invention of Double and Quadruple British National Looms by 'A Practical Master Weaver of Manchester', London, 1831.
3. Oastler and Bull helped in the preparation of the exchange with G. P. Scrope in Political Economy vs. the Handloom Weavers, Bradford, 1835.
4. William Atkinson, Principles of Political Economy ... being the Substance of a Case delivered to the Handloom Weavers' Commission, London, 1840.
5. Noted in J. T. Ward, The Factory Movement, p.135

> 'Shew to Parliament that there are means of relieving your difficulties without fettering wages, or abandoning improvements in machinery - that these means are practicable in themselves and not dangerous to the Community'.[1]

John Maxwell also reported the opposition of the House of Commons because of 'prejudice on free trade and sound currency'. He reported that many recognized that machinery was the cause of distress, but that it could not be taxed because this 'would be contrary to free trade'.[2] The reformers associated this intransigence with the unified oppression of millowners and political economy. A broadside from Bradford at this time played on this doctrinal use of political economy. The ideological differences between working class comber and middle class millowner were expressed through a debate between George Hadfield as the millowner and Charles Comber as the comber.

George Hadfield ... I'm against all monopolies.

Charles Comber ... It's queer - are you against Big Bens?[3] Before two years the Bradford combers will have to seek work in vain.

Hadfield ... They must <u>emigrate</u>.

Charles ... We like old England best.

Hadfield ... Would you fetter 'Capital and Ingenuity?'

Charles ... Would <u>you</u> fetter Industry?

Hadfield ... I am against all taxes on machinery.

Charles ... If we do not 'fetter' and 'tax' machinery, it will fetter and tax our backs and bellies.

Hadfield ... I'm for Free Trade.

Charles ... And 'Coarser Food'.

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1. <u>Preston Chronicle</u>, 19 April, 1834.
2. <u>Bolton Chronicle</u>, 13 September, 1834.
3. A Big Ben was the popular name for a combing machine.

George Hadfield ... I'm a Dissenter.

Charles ... So was Lucifer.

Charles ... Off steam looms, off big bens,
off Hadfield and his poor law
bill, and all his Scotch crew
by the next ship.[1]

An inquiry into the sources and incidence of distress over several sectors of the economy, including the weavers was conducted by the Select Committee on Manufactures, Commerce and Shipping in 1833. It made no recommendations.[2]

It was, however, succeeded by agitation in the North for wage regulation. Meetings were called in Bolton in late 1833 and petitions were ready by January.[3] Glasgow's weavers also met to petition for boards of trade in January.[4] By early March Robert Torrens, the Bolton representative was presenting three petitions to Parliament - one from the weavers, one from the borough representatives, and one from forty-five master manufacturers.[5] This was followed by similar moves to petition Parliament from other northern towns. Preston's weavers met in March, 1834,[6] as did Blackburn's,[7] and Bradford's.[8]

Not only petitioning, but meetings with sympathetic M.P.'s were carried on in several towns prior to John Maxwell's success in obtaining a Select Committee in June. Maxwell met with many of the weavers' delegations during this interval. Others like Hesketh Fleetwood and W. Bolling acted as go-betweens for the weavers and the House of Commons. Bolling reported on

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1. A Conversation between George Hadfield and Charles Comber, on Machinery, Emigration, and Free Trade, Bradford, 1834.
2. Select Committee on Manufactures, Commerce and Shipping, P.P. 1833, vi
3. Bolton Chronicle, 5 October, 1833, 25 January, 1834.
4. Glasgow Herald, 17 January, 1834.
5. Hansard, xxi, Col.1144.
6. Preston Chronicle, 15 March, 1834.
7. Manchester Guardian, 1 March, 1834.
8. Bradford Observer, 13 March, 1834.

his interview with Poulett Thompson on Maxwell's pending motion, and reported that Thompson thought the committee would be granted, though with an inquiry wide enough to 'ascertain how far the wages of other artisans affected the wages of weaving'.[1]

Parliament and the Weavers

A committee of fifty was appointed, headed by John Maxwell. Other principal members were Fielden, Bowring, Peel, Poulett Thompson, Stanley and Torrens. The committee, in fact, carried many of the same members as that on Manufactures, Commerce, and Shipping in 1833. Parnell, Poulett Thomson, and Fielden were principal members of both the 1833 and the 1834 Inquiries. The background of those who led the Handloom Weavers' Committee was diverse. Fielden, the radical, Maxwell, the whig, and Cayley, the tory directed proceedings.

Fielden, aside from his activities in the Ten Hours Movement and the National Regeneration Society, had also been involved in 1827 in the General Association, set up to bring in a bill for taxing all machinery. The 'Machinery and Protection of Labour Bill' gave substance to the ideas expressed in the 1820's for the taxation of machinery.[2] The handloom weaver, it was argued was placed under heavy disadvantage by the system of indirect taxation. A tax on power looms would equalize competition, and remove some of the burden from consumption goods. The petitions of the General Association were referred to the Select Committee on Emigration which responded:

> 'Your committee cannot express too strong an opinion against the idea of regulating the rate of Wages under any conceivable modification'.[3]

John Maxwell, too, stressed this contrast between untaxed machinery and the

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1. Preston Chronicle, 2 April, 1834 and 19 April, 1834.
2. Cf. Select Committee of the Artisans of Great Britain ..., 1824.
3. George Hilton, 'The Controversy Concerning the Relief of Handloom Weavers', Explorations in Entrepreneurial History, i, Series II, Winter 1964, p.170

heavily taxed weavers in his supporting pamphlet Manual Labour versus Machinery. His later writing revealed a prejudice against free trade and the emigration of operatives. He continued in his faith that manual labour generated more taxation revenue than machinery.[1] Maxwell continued the whig reform position of his father in Lanarkshire. E. S. Cayley was known for his opposition to Ricardian land policies.[2] His On Commercial Economy in Six Essays of 1830 developed an elaborate theory of over-production, gluts, and machinery.

For the first investigation in 1834, Maxwell called witnesses in favour of wage regulation along three different lines. The first system was proposed by the Bolton weavers and asked for legalization of wage scales arrived at by local boards of trade composed of masters and weavers. The Glasgow weavers proposed a nationwide system of wage regulation via boards of trade. Finally, John Fielden's own proposal was for a bill to make weaving rates dependent on the past costs of the largest masters. These average rates were to be the minimum rates for the region.[3] The already activated weavers' committees of each town sent their most articulate and well known representatives as delegates. The Bolton Committee, for example, selected Thomas Myerscough, Richard Needham, and John Makin, all known to previous committees, and active in the propaganda of the weavers' case.[4] But this investigation resulted in no recommendation by the Select Committee, though it did express favour for some form of parliamentary relief for weavers. The second report of the committee, after an investigation of those opposed to the measures, recommended Fielden's proposals as well as

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1. See John Maxwell, Manual Labour vs. Machinery, London, 1834, and Suggestions Arising out of the Present Want of Employment for Labour and Capital, London, 1852.
2. See his Corn, Trade, Wages, and Rent, London, 1826.
3. Report of the Select Committee on Handloom Weavers, 1835, P.P. XII, xx
4. Bolton Chronicle, 12 July, 1834.

protection against embezzlement for masters, and a cheaper legal form of indenture for apprentices.[1] A bill of these lines was introduced on 28 July, 1835 by John Maxwell, but was rejected by 129 to 41. It was raised again in 1836, repeatedly postponed and finally dropped.

Agitation continued in the immediate aftermath of the 1834 Committee. An august deputation on behalf of the weavers visited Alexander Baring and Viscount Lowther at the Board of Trade. The members of this included Lord Frances Egerton, D. Stuart, E. Stuart, Admiral Adam and Messrs. Maxwell, Turner, Brotherton, Bolling, Fleetwood, Lawson, Forbes, Gillon, Ainsworth, Fielden, R. Osward, E. Tennent, Brocklehurst, R. Wallace, and Cayley.[2] Weavers' local agitation also continued. The Paisley Harness Union, the Glasgow Harness Union, and the General Protecting Union all resolved to petition Parliament for a law to regulate wages again in October, 1835.[3] Government inaction rankled deeply when the story leaked out that William Ashworth, a Quaker manufacturer, after the Report of 1835, had written to Chadwick, the Poor Law Secretary, asking him to send agricultural labourers from the south to the north, that 'more handloom weavers are needed at Bolton'.[4]

Fielden moved to introduce another bill in December 1837. He persisted until he gained a Royal Commission. Russell brought in a Commission of four for an inquiry which was to be a rather different affair than that of 1834 - 1835. The Commission appointed consisted of Nassau Senior, S. Jones Lloyd, W. E. Hickson and John Leslie. The inquiry was to be a

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1. A discussion of the limitations and biases of this Select Committee can be found in D. Bythell, The Handloom Weavers, pp.162 - 164. Edward Baines in his History of the Cotton Manufactures of Great Britain attacked the Committee for bias on the side of the weavers, p.487
2. Preston Chronicle, 14 March, 1835.
3. The Weavers Journal, 31 October, 1835.
4. The Champion, 18 November, 1837.

wide ranging one into the state of the handloom weavers generally, and not just into their employment situation.[1] The commissioners were not expected to visit the weavers' districts, but rather to rely on assistant commissioners for fact gathering.[2] The spokesmen for the weavers attacked the composition of the committee. Senior had acquired odious distinction on the New Poor Law Bill and his opposition to the Ten Hours Bill. S. Jones Lloyd as banking theorist and classical economist was expected to support Senior. John Leslie was a West End tailor who became a convinced advocate of the New Poor Law. In 1834 he published three pamphlets on this.[3] W. E. Hickson, however, was a rather different member. He identified with the evangelical christian and early co-operative movement. In 1826 he edited the first co-operative magazine, and in 1831 attacked the S.D.U.K.[4] He had also served on commissions for juvenile delinquency, industrial schools, and repeal of the taxes on the press. The regional investigations were done by assistant commissioners, and Hickson visited all the regions to produce an overall report. But the investigation took two years and accumulated into five volumes of 1,400 pages. The slowness of the enquiry provoked Fielden into moving a resolution on the handloom weavers on 21 December, 1837. But the resolution had to await the report. The report and proposals were drafted by Senior. He saw the condition of the weavers as an inevitable result of excess supply of labour in the trade and made

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1. S. M. Phillips to Nassau Senior, 26 December, 1837, H.O. 74/1, pp.118 - 119, (Copy in Senior Papers).
2. J. Russell to Senior. H.O. 74/1, p.89. Senior Papers. Senior had, however, toured the factory districts in 1837 with Lord Fitzmaurice to ascertain 'the right as to the factory question'. Senior to Howick, 3 May, 1837, Senior Papers
3. See George Hilton, 'The Controversy Concerning the Relief of Handloom Weavers', pp.174 - 175
4. See W. E. Hickson, The Rights of Industry, London, 1831, p.3

proposals to reduce the number of weavers.[1] Education and reducing restrictive union practices in other trades were his major solutions. He viewed the impact of power loom weaving and technological unemployment as inevitable. He did, however, make some remote suggestions to alleviate conditions. The repeal of the corn laws would help to reduce the cost of consumer goods for the weavers. Furthermore, the foreign demand for cloth could be improved by measures to develop better fabric designs. Both measures were far removed from any possible practical policy question. The weavers and their supporters faced the immediacy of technological unemployment and the fundamental restructuring of the economy, which forced a recomposition of the workforce. The intellectual validity of their demands, grievances and responses takes its context from the genuinely realized political and social nature of technological change. The expression of these demands has its background in a tradition or language appealed to by tory radical, weaver, or liberal millowner.

Political Economy and Weavers' Resistance

The major issues in the debates over the condition of the weavers were fairly limited. The weavers struggled over two main issues. The first was the maintenance of the handloom via a tax on machinery. The second was wage regulation and the elimination of internal competition. The two areas of struggle were not necessarily exclusive, but many who took up the second issue denied the decisive impact of the power loom.

It was the benefit of the power loom, or of machinery generally which most interested political economists. Maxwell proposed a tax on machinery

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1. George Stigler, sees Senior's analysis in this report as superior because it resembled neoclassical allocation solutions. His assessment, however, is forced. He could just as easily have identified such elements in Smith, and indeed in many of the much earlier pamphleteers on the weavers. See 'The Classical Economists: An Alternative View', in Five Lectures on Economic Problems, London, 1949, pp.34 - 36

as early as 1840. This evoked a sharp rebuke from Ricardo, who argued that it was the duty of government to give the greatest possible development to industry. He, furthermore, saw the proposal as a violation of the 'sacredness of property which constituted the great security of society'.[1] T. P. Thompson, McCulloch, and Francis Place, in particular were obsessed with drumming into the weavers and into the working classes generally, their views of the benefits and the inevitability of technical progress. Place wrote a notable series of letters on this to the Bolton Chronicle in 1826, and was subsequently asked by the 1837 Commission to submit a memorandum on the condition of the weavers.[2] McCulloch raised the question a number of times in the pages of the Edinburgh Review, but was most explicit in his views on the weavers in his review of Babbage in 1833. T. P. Thompson wrote to various provincial newspapers, but carried on his longest and most significant exchange in the Leeds Mercury of 1840. Bowring and Scrope maintained inflexible doctrinal positions in their exchanges with the weavers' committees.[3]

Scrope argued that machinery itself was the produce of labour - that goods produced by the power loom rewarded one set of labourers rather than

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1. Hansard, (n.s.), ii, 29 June, 1830, 122
2. See Place letters in the Place Collection of Newspaper Cuttings, xvi. Place also deceived the Bolton Weavers Association in 1827 by offering to help them gain a committee of the House. On Place's own account, he regarded such a committee as an ideal platform for instilling in the work people the true principles of machinery. Place Newspaper Cuttings, xvi.
3. J. R. McCulloch, 'Effects of Machinery and Accumulation', Edinburgh Review, xxxv, 1821, and 'Babbage on Machinery and Manufactures', Edinburgh Review, lvi, January, 1833, 315 - 316, T. P. Thompson, 'Letters to the Leeds Times on Machinery', (March, 1840) in Exercises Political and Other, v, London, 1842. Copy of Correspondence between Dr. Bowring and the Associated Weavers' Committee, Kilmarnock, Kilmarnock, 1835. G. P. Scrope, Political Economy versus the Handloom Weavers, Bradford, 1835.

another.[1] McCulloch claimed the weavers could not complain about an innovation which could never cause injury.[2] The power loom had obviously increased employment by bringing more employment opportunities to the weaver's family.[3] And McCulloch, as noted already, despised the domestic system.[4] Senior argued that the power loom was of great advantage to working class consumption by reducing the cost of clothing.[5] Place simply reiterated his obsessive counsel on population.[6]

The weavers' associations were of a different mind. John Makin, one of the Bolton weavers' representatives feared the intervention of the economist.

> 'We have a fear that the opinions of theorists will have too great an operation against the practical opinion of the trade'.[7]

J. M. Cobbett advised Fielden as to how he should use the evidence of the 1834 committee reports and declared

> 'I do really look upon this body of evidence coming just at this moment as something calculated to check the mad economists in their career'.[8]

The Bradford weavers saw the powerloom as 'the great screw' both to handloom employers and weavers. The powerloom masters could undersell the

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1. G. P. Scrope, Political Economy vs. the Handloom Weavers, p.4. See also T. P. Thompson who argued that for every group losing on the introduction of machinery, two gained. T. P. Thompson, 'Machinery and the Labour Question', Letter to the Editor of the Leeds Times, No.1, March, 1840, or in Exercises Political and Others, v, 2
2. J. R. McCulloch, 'Employment of Machinery - Cause of Gluts', The Scotsman, 1824.
3. J. R. McCulloch, 'On the Economy of Machinery and Manufactures', p.316
4. J. R. McCulloch, 'Evidence to the 1825 Committee on Emigration', quoted in D. P. O'Brien, J. R. McCulloch, A Study in Classical Economics, 1970, see above Chapter III.
5. Nassau Senior, Three Lectures on the Rate of Wages, London, 1830, p.xvi
6. See Francis Place, 'Handloom Weavers and Factory Workers', in Pamphlets for the People, ed. J. A. Roebuck, i, London, 1835, pp.6 - 7
7. Report from the Select Committee on the Handloom Weavers, Petitions, P.P. 1834, x, 391
8. Fielden-Cobbett correspondence, 27 July, 1834, John Rylands Collection.

handloom masters 'by three or four shillings in a piece'.[1] Even if the power loom was not used on every type of cloth, it had the effect of reducing the value of cloth produced by the handloom.[2] They believed that technical progress had to be accompanied by redundancy of some classes of workpeople. They quoted the radical Wade, 'the direct tendency of them (mechanical improvements) is to substitute cheap for dear labour'.[3]

Many disputed the extent of the influence of the power loom. It was profitable only for certain fabrics and required a very large investment in fixed capital.[4] It was quite clear to many that the productivity of the power loom was not its greatest asset. Consistent production time, and control and supervision over manufacturing processes in the factory were powerful attractions to the manufacturer.[5] Working class discipline also had something to do with the differing labour conditions between the two techniques. The Bolton Committee was aware of this.

> 'The chief advantage of power looms is the facility of executing a quantity of work under more immediate control and management, and the prevention of embezzlement, and not in the reduced cost of production'.[6]

The power loom master had to keep his machinery running and had greater interest in keeping on good terms with his power loom weavers.[7] The competition of the power loom with the handloom was regarded as unfair. The remedy was a

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1. The Handloom Worsted Weavers' Central Committee, The Report and Resolutions, Bradford, 1835, pp.1 - 7
2. The Weavers' Journal, 30 Jan., 1836.
3. Bolton Chronicle, 1 March, 1834.
4. Select Committee on the Handloom Weavers, 1834, Testimony of Hugh Mackenzie and William Buchanan, Glasgow weavers, pp.77 and 150. Thomas Myerscough, a Bolton delegate, argued that the power loom had taken over most of the traditional Bolton cloth. Also see the testimony of Kirkman Finlay, a Glasgow Manufacturer in the Select Committee on Manufactures, Commerce, and Shipping, P.P. 1833, xi, 39. Finlay agreed with Mackenzie and Buchanan.
5. Select Committee, 1834, Testimony of John Makin, p.407
6. Committee of the Manufacturers and Weavers of Bolton, A Letter Addressed to Both Houses of Parliament on the Distresses of the Handloom Weavers, Bolton, 1834.
7. P.P. 1834, x, Testimony of James Turner, cotton yarn dresser, Manchester, p.621

tax on machinery. The demand was not unreasonable to the worker carrying a heavy burden of indirect taxation. R. M. Martin, brought to the 1834 Committee in his capacity as the author of a work on taxation argued 'The cloth made by machinery contributes less to the resources of the country than cloth produced by handlooms'. It was 'just and politic that this inequality be removed'.[1] And Edward Baines, member of the committee, presented a petition from the Leeds weavers

> 'It [power loom] ought to be made more available to local rates, but it unfortunately happens that the persons who have the power to lay the taxes are mostly interested in machinery ... the handloom weavers think that their labour ought to be protected as well as the farmers' corn, by a tax on power looms'.[2]

Senior scoffed at the proposals. A tax on the power loom would throw the power weavers back on the handloom. The tax would be a premium to the foreign manufacturer and take the place of his tariffs.[3]

The Weavers' Journal, voicing the interests of the Glasgow and Paisley Harness Unions and the Glasgow General Protecting Union held the position that the increase of wages due to rising taxation on provisions inevitably put the handloom weaver out of employment, and the untaxed power loom in his place.[4]

The tax on machinery was not a bizarre notion raised by a few cranks. It had so entered the tradition of the weavers' agitation that by the 1830's the ballad form also expressed the demand. An 'Operative of Keighley' wrote in 1834:[5]

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1. P.P. 1834, x, p.310. Testimony of R. M. Martin.
2. Second Report from the Select Committee on the Handloom Weavers, Parl. Papers, 1835, xiii, 230
3. Report from the Commission on the Handloom Weaver, P.P. 1841, x, 50
4. The Weavers' Journal, Glasgow, January, 1836.
5. The Weavers' Complaint, or a Bundle of Plain Facts ..., by an Operative of Keighley, Keighley, 1834, pp.1, 10, 32, and 37

'Draw near honest people of every degree
And listen a little, I pray unto me.
While I attempt to unfold in my tale,
A few of the tricks which in England prevail.

Then, first for the weavers, a set of poor souls
With clothes on their backs much like riddles for holes,
With faces quite pale, and eyes sunk in the head
As if the whole race were half famished for bread ...

For now the rich person, who once knew the poor,
Has grown quite a stranger, and knows him no more,
But keeps at a distance, like some mighty God,
And won't own acquaintance by even a nod ...

Then seeing, my friends, that you now live in times
When pride and oppression are no longer crimes,
Why should you not boldly of both take your fill,
And grind down the labouring class at your will?

A class which was never designed, it is plain,
To form any link in society's chain,
Excepting the part of a mere public hack,
To bear the whole weight of the rest on his back ...

For there let machinery, untaxed and free,
Bear down their tax'd labour to such a degree,
That all competition themselves to maintain,
Would prove an attempt both ridiculous and vain ...

The representatives of the Bolton weavers, however, did not concur with this position. Indeed it would have been inconsistent with their alignment with the 'respectable manufacturer'. They looked to the effects of home competition, and to the interests of the power loom weavers and the market for cloth generally. Such an action as the tax on power looms would only increase still more the export of yarn, and thus contribute to reduce the weavers' employment. The tax would only reduce the wages of those attending the machines. It would repress innovation, and 'it is only through improvements in machinery that our manual labour can be lightened'.[1] Fielden, too, changed his views on the taxation of machinery. He used both types of machine in his mills, and defended his position. He now, however, had greater

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1. P.P. 1834, x, Testimonies of Thomas Myerscough, John Makin, and William Longson, pp.358, 414, and 546

hope for agitation on lower taxes, a Ten Hours bill, and a minimum wage.[1]

While many feared that a tax on machinery would lead to greater foreign competition, others found an intimate connection between their ideas on the export of machinery and the power loom. William Longson of the Bolton weavers dismissed the connection between wages and population, and blamed foreign competition which had been encouraged by 'the export of machinery and by starving our most ingenious mechanics out of the country'.[2] Robert Torrens, true to his views of 1824 - 1825 argued that the export of cotton twist at low or nominal duties would 'extinguish handloom weaving in England, and cause power to be universally introduced'.[3]

Many of the economists came to recognize, at least, a massive problem of transitional unemployment among the weavers. It was probably the attention given to the weavers by parliamentary and provincial statistical inquiries which brought even some economists of extreme views, like McCulloch, to recognize frictional unemployment. Not only McCulloch but Babbage, T. P. Thompson, Bowring and Scrope reached some conception of the problems of mobility.[4] Bowring argued that machinery was a formidable rival and that weavers should prevent their children going into the trade.[5] Scrope went as far as suggesting that the government should provide some means of coping with these transitional difficulties.[6] But only Babbage in 1832 and Travers Twiss in 1844 actually made the effort to explain the survival of the handweavers'

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1. Letter to the Editor, The Champion, 24 Feb., 1838, and Cobbett-Fielden Correspondence, 28 Dec., 1838, John Rylands Collection.
2. William Longson, 'Wages, Competition, Population', Bolton Chronicle, 22 August, 1826.
3. Bolton Chronicle, 5 Jan., 1833.
4. T. P. Thompson, 'Machinery and Labour Question', Letter to the Editor of the Leeds Times, No.II, March, 1840, Exercises, Political and Others, v, London, 1843, 7. Charles Babbage, On the Economy of Machinery and Manufactures, London, 1832, pp.229 - 230
5. Sir J. Bowring, Correspondence between Dr. Bowring and the Associated Weavers' Committee, p.10
6. G. P. Scrope, Principles of Political Economy, pp.192 - 193

trade. They analyzed the nature of outwork, drew attention to the sub - contracting network, and explored the greater flexibility given to capitalist production through the maintenance of large pools of sweated labour.[1]

Torrens, while petitioning the House on behalf of the Bolton weavers in 1834 argued,

> 'When the introduction of new machinery increased production and augmented the wealth of the country, the country was bound in some shape or other to afford assistance to those classes who were reduced to destitution by the change'.[2]

Senior, inevitably, did not mention that part of his colleage, W. E. Hickson's report which challenged the assumptions of the inquiry. Hickson saw great harm in the social impact of machinery. It made 'mere machines of human beings' and the extreme division of labour alienated men and degraded the skilled labourer. He threatened that unless some reform was undertaken, political radicalism and chartism would succeed.

> 'in the People's Charter the working classes have a rallying cry which will give energy and concentration to their efforts'.

He predicted that the Chartist programmes, which included one for a tax on machinery and capital would 'break up the whole framework of society'.[3]

The second major issue discussed over the trade was wage regulation and internal competition. The possibility of a minimum wage was not conceived of by political economists. It was consistently demanded by weavers as well as many manufacturers. Behind demands for wage regulation and the weavers' boards of trade was the theory of the 'slaughterhouse' grinding system, of the 'dishonourable' employer, and of 'unprincipled competition'.[4] This faith

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1. Charles Babbage, Machinery and Manufactures, pp.181 - 186 and Travers Twiss, Two Lectures on Machinery, Oxford, 1844, pp.33 - 38 and 54 - 56
2. Col. Torrens, 'Speech', Hansard, 11 July, 1834, pp.377 - 378
3. Report of W. E. Hickson, Appendix to the 1841 Report on the Condition of Handloom Weavers, P.P. 1840, xxiv, 44 and 71
4. See Weavers' Journal, 31 Dec., 1835.

in the philanthropy of the large manufacturer and inherent ill will of the small manufacturer was not unanimous. There was some suspicion that small owners were used by the larger, and that the larger owner was also responsible for triggering reductions. Placing the power of wage regulation in the hands of the higher paying master was in his interest. It would be a way of eliminating much of his competition.[1] But the weavers' associations banded together to secure stable price lists. William Thompson spoke for the Glasgow General Protecting Union of Handweavers

> 'We are the cheap machinery of our employers, we cost them nothing, and therefore, we can undersell one another ... but their capital is not materially injured'.[2]

The weavers regarded this competition of capital as the theft of their former rank in the industrial world. They spoke of a 'war of capital' which 'exists to a certain degree every day'.[3] The Owenite New Moral World analyzed the emergence of a 'reserve army of labour'. It argued that consumption depended on the value of labour, and that labour was now depreciated in value by technical progress.

> 'In this state of things with the increase and increasing perfection of machinery and a limited home consumption, there will obviously always remain a redundant proportion of manual labour which capital and competition may work with as it wills'.4

The State, the Poor, and the Weavers

The official response to the weavers' critique of technology and the direction of the total economy was ambivalent. However, discussion of a policy towards technology as well as economic development was a fundamental aspect of politics. This is clearly reflected in the differing procedures of investigation behind the Committees of 1834 - 1835 and 1837 - 1839. The

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1. P.P. 1834, x, see Testimonies of Kingman and Thomas Myerscough, 26 and 347
2. The Glasgow Herald, 29 August, 1834. Cf. William Pilling's statement for the Bolton Weavers' Association, Bolton Chronicle, 25 Jan., 1834.
3. William Thompson, Glasgow Herald, 29 August, 1834.
4. New Moral World, 6 Jan., 1838.

1834 - 1835 Committee assumed there should be some measure of control over economy and technology. Questioning proceeded along the lines of the reasoning produced by tory and working class groups over the last decade. Witnesses were grouped into supporting and opposing sides and interviewed in turn. Testimonies were used to modify the views of the Committee. The 1837 - 1839 Commission, on the other hand, was set up as a social science project on the model of the Poor Law Commission Inquiry.[1] Senior issued guidelines to the Commissioners for classifying grievances and identifying areas of distress. He used the recommendations of the previous Committee in 1834 - 1835 as hypotheses to be tested and disproved.

The 1834 - 1835 Committee addressed itself to questions about the impact of developments in the wider economy on the weaving workforce: the impact of steam looms, home competition and speculation, foreign competition, heavy taxation, monetary instability. The final report emphasized home competition and recommended local boards of trade. It attributed little distress to the impact of power looms, and so gave little support to the longstanding call for a tax on machinery.[2] The 1837 - 1839 Commission accepted the directions of the wider economy and did not challenge the tendencies of industrialization and growth. It addressed itself instead to the individual conduct of the workmen. Senior instructed assistant commissioners carefully to investigate the extent of unionization and strikes in the trade. They were to investigate the 'population problems' of the trade, and to investigate the level of 'diligence and frugality' of the weavers.[3] Senior argued in his Report that the cause of distress was the excess number of weavers in unskilled branches of the trade, and that education in

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1. P.R.O. (Home Office Papers 73/63) Senior to Russell, 19 August, 1837, (Transcribed in Senior Papers.)
2. P.P. 1835, xiii, 15 - 30
3. See 'Instructions from the Central Board of Handloom Weavers' Inquiry Commission to the Assistant Commissioners, Appendix to the Report of the Commissioners on Handloom Weavers, P.P. 1841, x, 129

'diligence and frugality' would help the weavers, as it would the rest of the working classes. The suspension of all union barriers to entry in other trades, and the elimination of union wage demands would give the weavers greater opportunities for leaving their trade.[1]

The report on the condition of the handloom weavers was not an outstanding document for its time. The context for the novelty of Senior's assessments and the whole approach of the inquiry was not the 1834 committee, but the massive statistical investigations of the time carried on in many provincial societies. The surveys of Glasgow, Nottingham and Miles Platting set out the massive poverty of the domestic outworkers before Senior even wrote up his report.[2] Senior's report, in addition, affirmed some of the prejudices these earlier reports had tried to escape. Education and the evils of unionization were still the major interest of Nassau Senior. But William Felkin, for example, by no means a radical, had told the British Association in 1837 that the problems of the working classes were not questions of 'morals', but questions of the distribution of income.

> 'Many from amongst the working classes have exhibited vast mental and imaginative power, and have attained to a high moral elevation. When the mind is at ease on account of worldly circumstances, there is much in the nature of their ordinary employments to facilitate the exertions of the mind'.[3]

Later he even challenged the superiority of the factory. He added in his

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1. Report from the Handloom Weavers Enquiry Commission, P.P. 1841, x, 98 - 118. Senior's views on trades unions can be assessed from his involvement in a Report on Combinations by N. W. Senior and Thomas Tomlinson presented to Rt. Hon. Lord Viscount Melbourne, Secretary of State, 20 August, 1832. This went as far as a survey of certain anonymous manufacturers such as Mr. Z, to ascertain among other things, 'the way in which existing habits of combination affect the manufacturing population, and disturb the division of labour, the improvement of machinery, and manufacturing processes. Senior Papers.
2. See Reports in the Journals of the London Statistical Society, 1834 - 1839.
3. William Felkin, Remarks upon the Importance of an Inquiry into the Amount and Appropriation of Wages by the Working Classes. Addressed to the Statistical Section of the British Association. Liverpool, 13 September, 1837, London, 1837, p.15

> 'At present, I do not see reason for deciding that all labour in connection with weaving machinery, must be subject to the uniform, automatic, system of operation which obtains within the gates of a factory, in order to secure good work, fair wages, or reasonable profit'.[1]

Senior's conclusions delivered in his scientific prose, however, had a tone of finality:

> '... the unequal race continues till the handloom weaver, finding the united wages of himself and his family unequal to support life is gradually ground out of the market and forced to endeavour to find some other employment ... The cause of the low earnings of the handloom weavers is the disproportion between their numbers and the demand for their labour ... it follows that no measure can effectually raise their earnings except by getting rid of that disproportion'.[2]

Maxwell's bill for wage regulation in 1835 had been rejected. The possibility of wage regulation was not even considered by the Royal Commission which reported in 1841. Between these periods the weavers turned to the union. The Weavers Journal of 1836 argued that the union increased the value of labour and secured it against reductions. It advanced social and economic independence and protected the capital of the honourable employer. But the weavers' unions were generally short-lived and died out in bad trade.[3] The Kilmarnock weavers despaired 'in our case so great a body cannot well unite in their defence - any upstart ... can be the means of reducing wages and ... compelling all other to follow'.[4] The Carlisle weavers concurred with this,[5] and Baird found the Glasgow unions to be very weak.[6] John Scott, a Salford

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1. William Felkin, An Account of the Machine Wrought Hosiery Trade. Extent and the Conditions of the Framework Knitters, read in the Statistical Section of the Second York Meeting of the British Association, 18 September, 1844, (2nd edition London, 1845), p.39
2. P.P. 1841, x, 25 and 124
3. The Weavers' Journal, Glasgow, 1 March, 1836.
4. J. Bowring, Correspondence, 1835, Letter IX, p.12
5. J. Barr, Secretary to the Carlisle Weavers' Commission, quoted in P.P. 1840, xxiv, R. M. Muggeridge's Report on the Condition of the Handloom Weavers of Lancashire etc., 594
6. J. Baird, 'On the Poorest Class of Operatives', p.171

weaver reiterated the difficulties of the handloom weavers' circumstances - a large pool of labour that thwarted the success of any strike, and the scattered and isolated nature of the work which made communication and organization difficult.[1] But the situation was not impossible in all places. The Paisley weavers established a scale of prices in 1829 and maintained it for some time, and strikes were effective until the mid 1830's.[2] Unionization, as I have noted, was not impossible in places of specialized production.

From the point of view of many political economists, the weavers acted out the drama of the movement from workshop to capital and machinery based production. They were the degenerating artisans, the 'poor outworkers', who became replaced by the factory hand. The economists' prediction was, however, uncertain enough in these fragile years of change for the weavers to raise a powerful and impressive critique of machinery, a critique that carried a genuine belief that technical change was not a 'given', but could be tempered and directed to match the requirements of social ideals. This critique was all the more provocative for its 'exposure' of technical change, its attempt to find an underlying connection between the techniques of production and the total economy and society.

The weavers survived after the 1830's, not because they had managed to withstand the ideological barrage of the factory man, but because they were part of a system more complicated than that seen by millowner and economist. The weaver continued his domestic work, not in many cases because he wanted to, but because as Peter Gaskell argued, factory work for the adult male was hard to obtain.[3] Small scale industry continued, as Babbage pointed out, because it provided special conveniences to large scale industry. It

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1. P.P. 1840, xxiv, Report of Muggeridge, Assistant Commissioner, 599 - 600
2. J. Bowring, Correspondence, pp.17 - 20
3. Peter Gaskell, Artisans and Machinery, London, 1836, p.331

survived, too, because with every advance in technique, manufacturers with inferior machinery sought some compensating mix of techniques.[1] Here the domestic worker had a very great advantage. He was cheap. The inevitability of the weaver's decline was not pre-determined. His sub-contracted labour was hardier and more efficient than was expected. It dragged on, as Landes points out, in those trades where the technological advantages of power machinery were small (as in certain types of weaving)[2], and it survived in symbiosis with the factory. The expansion of outwork in many other trades was integral to the process of technical change and industrialization in the Nineteenth Century. The technological advance which bewitched the early Nineteenth Century economist created more craft and traditionally organized industry than any early Nineteenth Century economist, and many present day historians, have cared to admit.

The 'condition of the handloom weavers' impressed the middle classes as the most obvious case of suffering from industrialization. Many industrialists and political economists used the condition of the weavers as a contrast to the superior standards of factory workers. They predicted all encompassing benefit from industrialization, and viewed the immobility of the weavers in face of the competition of the power loom as irrational. The policy controversy in the 1830's over the weavers did, however, bring some understanding, if little action, on the ambivalent nature of economic transition. The weavers, however, were fitted all too easily into the philanthropic concerns of the middle classes for the 'poor'. At the disposal of the statistics societies and parliamentary commissions, they were investigated as the 'poor'. Great attention was paid to their morals, health, education and family life, and little to the organization of their work and

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1. Charles Babbage, Machinery and Manufactures, (1st edition 1832), pp.183 - 186. Also see Travers Twiss, Two Lectures on Machinery, Oxford, 1844, p.43
2. David Landes, The Unbound Prometheus, pp.118 - 119

their wages. The weavers, themselves, consistently drew attention to piece rates, home competition, and the specific technical and market conditions for the introduction of power looms. They demanded a policy on technology. The middle classes were, however, all too ready to have these difficulties which clouded 'improvement' shunted off into the 'problems of poverty'.

Policy debates on the weavers, unlike the debates on the export of machinery and the emigration of artisans did not generate newly questioning attitudes. The export of machinery problem generated wide ranging debate on all aspects of technical change. The exceptions it seemed to pose to generally accepted doctrines stimulated new ideas. The handloom weavers' innovation of a policy on technology did not stimulate much more than philanthropic concern. The handloom weavers were, however, an example to the middle classes of their own failure to bring harmony over the enduring issue of machinery and labour. During the Industrial Revolution, a period of rapid technical transformation, a central base for class struggle was the very point of production. These debates have indicated how the engineers struggled over the ownership of their skills, and how the weavers fought the dilution and mechanization which took their craft and their jobs. It is little wonder that the middle classes looked to the political economist and to their scientific culture to enforce the inevitability and neutrality of their own threatened 'improvement'. The every day struggle between master and worker over the very techniques of production was central to the formation of both middle class and working class consciousness during the first Industrial Revolution.

CONCLUSION

This thesis posed the problem of conceptions in political economy of technological change during the Industrial Revolution. It has outlined some of the ways in which these times of rapid economic and social transition were reflected in contemporary economic thought. Further, the overt and ever conscious concern with the machinery and labour question fell within the scope of a broader discussion of technology and improvement. The thesis was constructed by the alignment of many texts which commented in any way on these problems in the period between the end of the Napoleonic Wars and the depression of the 1840's. This collection and alignment of texts in political economy revealed a literature of improvement, generally expressed in terms of criticism of Ricardo. This message was quite unlike those images of gloom and pessisism generally associated with the 'dismal science' during these years.

The literature was a varied one, but as far as generalization is possible, it did take on certain patterns. What emerged as the dominant feature of analysis in the 1820's appeared to be the division of labour and labour productivity. This pattern shifted in the 1830's to a political economy concerned primarily with fixed capital formation. The political economy which emerged in the 1830's was both comparative and historical. It made use of hypothetical history and ethnographic studies to highlight the contrasts between the stagnation of savage society and the improvement of civil society. This political economy ranged from studies of the social and political context of technical change to detailed analysis of methods of gaining control and direction over all aspects of the labour process. The thesis, in addition, made some gestures to indicate that there may be some structural connections between these patterns in economic thought, and the tendencies and directions of change in the economic structure as a whole.

Those phases within industrialization outlined by Marx as 'manufactures' and 'modern industry' seem to emerge in the different patterns of ideas in the 1820's and the 1830's.

Political economists became the philosophers of a new social order. It was they who were expected to go beyond the attempts of factions and social groups to stabilize that transitory order in ways which best suited their own special interests. Political economists, by necessity, absorbed, yet also reformulated the social ideals and political imagery generated around the machinery question. As Carlyle put it, 'the introduction of power [steam power] into the social system' which brought greater total wealth but also greater distance between the rich and the poor 'will be a question for political economists and a much more complex and important one than they have yet engaged with'.[1]

This political economy of improvement found a kindred spirit in the culture of improvement within the scientific and statistical movement. The scientific movement, within its Mechanics Institutes and its local scientific societies, sought to incorporate scientific and technical advance in economic improvement. These societies attached political economy to their movement. The statistics societies mobilized the study of the social impact of industrialization and sought to devise a 'scientific philanthropy'. In doing so they conceived of themselves as the new political economists, revitalizing and extending the frontiers of the science of their Ricardian forebears.

The scientific movement also incorporated into its very aims and programmes the predictions of political economists on the nature of the labour process. The Mechanics Institutes gave social definition to hierarchies within the labour market. They used, in addition, the rhetoric of

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1. Quoted by Raymond Williams, Culture and Society, 1780 - 1950, Harmondsworth 1961, p.86

the 'ingenious artizan' as a suitable camouflage for greater concern with a well disciplined factory labour force. The statistics societies dealt with the urban and 'moral' problems arising in the process of meeting the new labour needs of the industrial system. Moreover, they dealt increasingly with the outcasts of the factory system - the degraded artisan or outworker.

The words and concepts used within this movement changed their meanings and significance. Many of these terms were also those much used in political economy. Terms such as art, science, skill, industry, labour, and machine took on new meanings and significance during the course of the Industrial Revolution. Quentin Skinner has pointed out how linguistic change helped to connect the motivations of the Christian and commercial ethics during the Puritan Revolution. Raymond Williams' recent study of the language of cultural transformation charts some of these changes in meaning coincident with the rise of capitalism, and further, traces other new meanings and interpretations coincident with industrialization.[1] This thesis has looked at the use of concepts like these in political economy, and in the cultural and political arenas of technology. It has uncovered some of the actual contexts in which these words were changing their meanings, and has looked at the 'practice' of the middle class ideology of improvement. It is, nevertheless, striking that ideological struggle left its mark in the transformation of the very meaning of words. Some of the results of the changes in perceptions and the struggles over the conceptualization and identification of the Industrial Revolution can be highlighted by detailing some of the actual word changes.

The term 'art' changed in the course of the Industrial Revolution' from an emphasis on skill to sensibility. The distinction between 'art'

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1. Quentin Skinner, 'Some Problems in the Analysis of Political Thought and Action', Political Theory, ii, No.3, August, 1974.
Raymond Williams, Keywords, Glasgow, 1976.

and 'industry', between 'fine art' and 'useful art' was based on the exigencies of exchange in the market.[1] With this, the idea of the artisan as a general skilled craftsman was replaced by new terms - factory operative or hand as opposed to hand labour or domestic worker. The older term remained in use, but its meaning became ambiguous and dependent on the political or social overtones given it by different groups of critics or enthusiasts of the new order.[2] The term 'science' referred, until the early to mid Nineteenth Century, simply to methodical and theoretical demonstration. It was not until the Nineteenth Century and the change in the focus of ideas to the material, physical and natural basis of human society that science came to connote the methodical study of nature.[3] 'Skill' and 'industry', significant and emotive terms throughout the arenas of discourse on the machinery question clearly revealed the political meaning of terminology. 'Skill', defined by the political economist, was a 'dexterity' derived from the division of labour. It was 'industrious habits' acquired in the factory. 'Skill' defined by the craft worker or working class radical was a special attribute or 'genius' learned in the process of acquiring a trade. It was the inalienable property of the working man. Industry had a dual meaning. It referred both to diligence and to a particular organization orientated to production or trade.[4]

Labour and machine also connoted new social associations. Political economists narrowed the meaning of labour from all productive work to a particular factor of the production process. Labour was an element which combined with other elements, capital and raw materials to produce commodities. Labour became a component to be hired, and the labour market was defined as

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1. Raymond Williams, Keywords, pp.33 - 34
2. See chapters four and eight of this thesis.
3. Raymond Williams, Keywords, pp. 233-234
4. See chapters two, four and seven of this thesis.

a pool of persons ready to sell their labour.[1] Machine, in the Eighteenth Century, came to mean a complex apparatus of inter-related parts moved by power. In the Nineteenth Century, the word evoked images of steam power, the factory, large scale production, and the displacement of the craft by capitalist control. Thus one understands the radical Lovett's proclamation that he did not 'speak against the men, but against the machinery - the system',[2] and Carlyle's allusions to 'mechanical civilizations'.

The way these words changed their meanings during the period of the Industrial Revolution is revealed in the economic writings and the popular culture of the times. This language, in which whole changes were common to the intellectual, social and political spheres, also indicates some common structure to themes and ideas between economic thought and middle class culture. There was, above all, awareness, across all these areas, of something referred to as an 'irreversible social change' consequent on 'industrial transformation' - the Industrial Revolution.

In the politics of machinery - in this thesis discussion has been limited to debates on the export of machinery and on the handloom weavers - thematic preoccupations and shifts of meaning too are similar to those of the cultural-social and intellectual dimensions. The ways in which the industrialist sought to protect or to extend his trade, and the nature of struggle in the workplace as the workman sought to preserve his craft, entered into and shaped the historical awareness and sense of future of the general culture. It cannot be said, however, that these perceptions were in some way rooted in society, nor that they were given or shaped by the intellectuals. First, it is impossible to arrive at the truly 'popular'

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1. Raymond Williams, Keywords, pp.546 - 547
2. 'The Radicals debate Machinery', Magazine of Useful Knowledge, Co-operative Miscellany, London, 30 October, 1830.
   I owe this source to Barbara Taylor.

opinion because one can only hear the articulate - those able to make their way into the avenues and organs of the public voice. Conversely, one cannot discern from these perceptions what the intellectuals were doing. Their real intent was often far from their perceived roles and doctrines. The debates, above all, reveal the complex interactions of the use of ideas in politics, the reshaping of these ideas for political ends, and the emergence from this of novel theoretical significance in particular ideas and concepts.

This thesis has traced one theme, the machinery question, within the structure of economic thought. This structure of economic thought was defined in terms of the relations between theory, cultural organizations, and policy - all three of which entered into the contemporary's perception of 'political economy'. The analysis of this structure forms a part of the analysis of culture. It is not sufficient to accumulate separate histories of theory, voluntary societies, and policies. Analysis of the structure of economic thought, though a part of, is also like the analysis of culture. It requires perception of the relationships between particular histories. These relationships constitute the pattern of the whole culture.

This thesis has attempted one small part of such an analysis. It has focused on the vision of the 'Age of Machinery' in the economic thought of the middle classes in the period of their rise to dominance. It has shown the ways in which political economy, at this time, the 'science of economy and society', related to the new realities of scientific and technological change. Finally, it has traced the pattern of the intellectual, social and political formulations of this vision, and through this pattern, indicated some of the ways in which economic thought was integrated into its society.

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