

MATERIAL WORLD: THE MYTH OF THE 'WEIGHTLESS ECONOMY'

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'The Death of Distance', 'Weightless World',² the 'Connected Economy',³ the 'Digital Economy',⁴ the 'Knowledge-Based Economy',⁵ the 'Virtual Organization'.⁶ All these phrases were culled from the titles of books published in the six months prior to writing this essay, in spring, 1998. They could have been multiplied many times: 'virtual', 'cyber', 'tele-', 'networked' or even just 'e-' can, it seems, be prefixed interchangeably to an almost infinite range of abstract nouns. Without even straying from the field of economics, you can try 'enterprise', 'work', 'banking', 'trade', 'commerce', or 'business' (although the device works equally well in other areas: for instance 'culture', 'politics', 'sex', 'democracy', 'relationship', 'drama', 'community', 'art', 'society', 'shopping' or 'crime').

A consensus seems to be emerging – in economics as in other fields – that something entirely new is happening: that the world as we know it is becoming quite dematerialised (or, as Marx put it, 'all that is solid melts into air') and that this somehow throws into question all the conceptual models which have been developed to make sense of the old material world. We are offered a paradoxical universe: geography without distance, history without time, value without weight, transactions without cash. This is an economics which sits comfortably in a Baudrillardian philosophical framework, in which all reality has become a simulacrum and human agency, to the extent that it can be said to exist at all, is reduced to the manipulation of abstractions. But these books have not been designed as contributions to postmodernist cultural theory; far from it. Frances Cairncross's *Death of Distance* comes with a glowing testimonial from Rupert Murdoch on the front of its shiny blue dust-jacket, while Diane Coyle's *Weightless World*, not to be outdone, carries an endorsement from Mervyn King, executive director of the Bank of England, on its back cover. These are not

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academic inquiries into the nature of the universe; they are practical manuals for managers and policy-makers. A new **orthodoxy** is in the making, an orthodoxy in which it becomes taken for granted that 'knowledge' is the only source of value, that work is contingent and delocalisable, that globalisation is an inexorable and inevitable process and that, by **implication**, resistance is futile and any assertion of the physical claims of the human body in the here-and-now is hopelessly old-fashioned. The implications of this emerging 'common sense' are immense. Capable of shaping issues as diverse as taxation, employment legislation, levels of welfare spending, privacy **rights** and environmental policy, these notions serve to **legitimise** a new political agenda and set the scene for a new phase of capital accumulation.

The task I have set **myself** in this essay is to re-embody cyberspace: to try to make visible the material components of this virtual world. In this, I find myself rather oddly **positioned**. Having been arguing for over two decades for greater importance to be given in economic and social analysis to white-collar employment, and to the ways in which information and communications technologies have facilitated its relocation, it seems perverse, to say the least, to respond to this sudden new interest in the subject by saying, in effect, 'Well, hang on a minute. Are things really changing all that much? How 'dematerialised' are most developed economies? To what extent is service employment really expanding? What contribution does 'knowledge' make to economic growth? And how global are most economies anyway?'

In addressing such questions a delicate path has to be picked. On the one hand it is necessary to subject the claims of the proponents of the 'new economics' to some empirical tests. Before throwing out the bathwater, in other words, it is wise to check it for babies. On the other, it is necessary to avoid the opposite **danger** of assuming that nothing has changed: that because something cannot be measured accurately with existing instruments it does not exist at all. I cannot claim to have walked this path to its conclusion. However I hope here to have flagged some of the more important landmines to be avoided along the way. If I have not found solutions, I hope I have at least identified some problems.'

At the risk of appearing pretentious, it does seem necessary to set the problem in its epistemological context. The current hegemonic position of postmodernism in most university departments (with the partial exception of the 'hard' sciences) has created a number of obstacles to addressing such questions.*

First, and most obviously, postmodernism throws into question the

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very scientific project **itself**. Even to admit to trying to discover the 'truth' about what is happening is to run the risk of being accused of vulgar positivism. If one accepts that all facts are contingent and socially constructed there is no rational basis even for selecting the data with which to test an argument, let alone for claiming any special validity for one's own discoveries. This is not the place for a detailed discussion of how – or indeed whether – it is possible for a scholar to find a third route, which avoids both the hard rocks of crude positivism and the swampy morass of relativism to which such an approach inevitably leads.'

Second, by insisting that all science is socially constructed, **postmodernism** makes it very difficult to produce a stable concept of the body – the flesh-and-blood body which gets on with the business of circulating its blood, digesting, perspiring, shedding old cells, lactating, producing semen, menstruating and a myriad other functions (including, no doubt many that a positivist might describe as 'yet to be discovered') regardless of what its inhabitant is thinking. The problem is urgent: how to resolve the crude dualism which is set up when 'the biological' is counterposed to 'the social' (or 'nature' to 'culture', 'body' to 'mind', 'manual work' to 'mental work', 'the material' to the 'ideological', that which is studied to the scientist, and so on). But postmodernism has yet to produce a definitive resolution to this difficulty. Baudrillard's solution is to **regard** the human body itself as just another culturally constructed **simulacrum**.¹⁰ An alternative model, proposed by Donna Haraway, is to acknowledge the ways in which science and technology have penetrated the natural by proposing that the body cannot be viewed independently from its cultural surroundings but has, in effect, become a cyborg." In both of these approaches the **body** is reduced to a cultural construct, which has the effect of rendering its materiality difficult to grasp and analyse. This is relevant in this context because without a concept of the body as something distinct and separate from capital (or any other abstraction) any theorising about the weightless economy will be circular: one is, in effect, trying to see the place of labour in the capital accumulation process having already written out the possibility of being able to define (and measure) that labour.

The post-modernist approach has also led to a third problem which is pertinent in this context: the conception of 'culture' as series of discourses, endlessly renegotiated and reproduced by all those who participate in them. This, combined with the focus on semiotic analysis to analyse these discourses, makes invisible the fact that

cultural products such as books, films, 'science' or advertisements – and the 'ideas' they contain (at least to the extent that these are a conscious result of mental effort) are also the products of human intellectual and physical labour. Without some means of modelling, and measuring, this labour (whether waged or not), it is extremely difficult to make analytical sense of the 'weightless economy'.

Having outlined some of the difficulties, let us go on to examine the main tenets of the 'weightless economy' school. Three quite distinct themes emerge in this literature: dematerialisation; the 'productivity paradox' and globalisation. **Although** these are capable of being separated from each other conceptually, they tend in practice to be discussed together.

One of the **leading** proponents of the dematerialisation thesis is Danny **Quah**,¹² a Harvard-trained econometrician who is a professor at the London School of Economics. His central argument is that the economy is becoming increasingly dematerialised with intangible services increasingly replacing physical goods as the main sources of value. He **distinguishes** two aspects of dematerialisation which he **regards** as having macroeconomic importance: 'The first is simply increased weightlessness deriving from the growth of services – as opposed to, say, manufacturing in particular, or industry in **general**. The second is dematerialisation deriving from the increased importance of **IT**'.¹³

Let us look first at the **growth** in services. It has been an article of faith in most of the literature, at least since Daniel Bell first coined the term 'post-industrial society' in the early 1970s, that a, if not the, major trend of the 20th Century has been the rise of services at the expense of agriculture and **manufacturing**.¹⁴ The most usual measure of this rise is service employment, and it is readily illustrated by graphs (usually derived from census data) showing employment in services soaring heavenwards as the century progresses, whilst employment in agriculture and manufacturing falls dramatically. Before going on to a more detailed discussion of service employment, it is worth noting several difficulties with this representation.

First, the standard industrial classification system, which is used as a basis for assigning workers to sectors, fails to take account of the major changes in the division of labour which accompany technological change and the restructuring of economic activity, both in terms of ownership and of organisation. Thus, for instance, the 'decline' of agricultural employment, which is visible in terms of the numbers of people actually working on the land, can only be demonstrated by

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leaving the mechanisation of farming and the commodification of food production out of the picture. If you were to include, for example, all the people employed in making tractors, fertilisers and pesticides, and all the people engaged in packing and preparing food, and those involved in its distribution to supermarkets as part of the agricultural workforce, the graph would slope much less steeply. Similarly, the decline in **manufacturing** employment is usually demonstrated within a particular national context, or that of a group of nations (for instance the OECD nations, NAFTA or the EU). This fails to take account of the **manufacturing** employment which has simply been relocated to another part of the globe (although it may still be carried out by the same companies, based in the same countries and retaining their service employment there). Finally the growth in service employment over the course of the century can only be demonstrated convincingly by leaving out domestic servants, whose numbers have declined steadily as employment in other forms of service work has **risen**.¹⁵ In Great Britain, for instance, domestic service accounted for 40% of all female employment in 1901, but had fallen to 5.2% by 1971.¹⁶

These **qualifications** aside, there are deeper difficulties involved. Any analysis which uses as its raw material aggregated data on 'service activities', whether these are derived from employment statistics, output data or other sources, is in effect collapsing together several quite different types of economic activity, involving contrasting and contradictory tendencies. While it may be possible to make out a case that dematerialisation is taking place in some of these, it is my contention that in others precisely the opposite tendency is occurring, and that in the long run this tendency of commodification, or the transformation of services into material products, is the dominant one in capitalism.

The aggregated category 'services', which Quah and others use as the basis for their calculations, can be broken down into three distinct types of **activity**. The first of these consists **essentially** of a socialisation of the kinds of work which are also carried out unpaid in the home or neighbourhood. It includes health care, child care, social work, cleaning, catering and a range of personal services like hairdressing. It also includes what one might call 'public housekeeping' such as the provision of leisure services, street cleaning, refuse collection or park-keeping. Even 'live' entertainment – and the sex industry – can plausibly be included in this category. (Under the standard industrial classification scheme (SIC) it is mostly classified under 'hotels, catering, retail and wholesale distribution', 'miscellaneous services' or in the public sector, although it is not coterminous with these categories.)

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Whether or not outputs from these activities or employment in these sectors are visible in the economic statistics varies according to a number of factors including demographic structure, the **degree** of political commitment to providing public services, cultural variations, the extent of female participation in the workforce and what **Gøsta Esping-Andersen** has described as 'de-commodification', defined as 'the degree to which individuals or families can uphold a socially acceptable standard of living independently of market participation.'" These activities become visible in the public accounts when they are first socialised and enter the money economy: when, for instance, it becomes possible to attend a public concert instead of singing around the piano at home, to take an ailing baby to a clinic or to get one's legs waxed at a beauty salon. Conversely, they revert to invisibility if they are not available in the market. If, for instance, a **political** decision were made to abandon the state provision of school meals, employment of school meals staff would decline, but this would not necessarily mean that the labour of preparing such meals had disappeared; it would in all likelihood simply have re-entered the sphere of unpaid domestic work.

I have argued elsewhere that it is not simply the boundary between paid and unpaid labour which is permeable and shifting here; this kind of 'service' activity is also in an active process of **commodification**.¹⁸ The general tendency is for new technologies to be used, not to dematerialise these activities but to materialise them (albeit in some cases with more and more 'knowledge' embedded in the new commodities). Thus we have a historical progression from washing clothes in the home as an activity either carried out unpaid or by the labour of paid domestic servants, via the provision of public laundries (staffed by 'service' workers) back into the home where it is now once again generally carried out as unpaid work but using an ever-burgeoning variety of new commodities such as washing machines, detergents, tumble dryers, fabric conditioners and steam irons. These undeniably material goods are made in factories and transported physically from these factories by various means to a **growing** proportion of homes throughout the world. The need to purchase them serves as one of the many ties pulling the '**underdeveloped**' portions of that world ever more tightly into the cash nexus.

Washing, of course, is not the only activity which has been commodified in this way. One could point with equal justification to the processed food industry or the drugs industry as examples of commodified domestic labour. A random perusal of the advertisements

in the room as I write this article throws up 'lunch-box-sized individual fruit-flavoured portions of **fromage** frais' (packaged in foil tubes!), 'panty-liners with flexible wings', 'under-eye moisturiser' and a 'universal remote control'. Not only can all of these commodities be traced readily back to their origins in unsocialised activity it would also be fair to say that none of them, with the possible exception of the moisturiser, would have been conceivable a generation ago; the ability of capitalism to generate new commodities can seem almost magical, as though they are being conjured out of the air in a **perfect** reversal of the 'dematerialisation' hypothesis. We must remind ourselves, however, that their raw materials come from the earth and that the only magic involved is human inventiveness and labour.

A few statistics on the consumption of these raw materials underline the point: in the UK, iron consumption has increased twenty-fold since 1900; the **global** production of aluminium has risen from 1.5 million tonnes in 1950 to 20 million tonnes **today**.¹⁹ In the decade 1984-1995 (during a period in which we should have seen the 'weightless' effect becoming visible, if the theorists are to be believed) aluminium consumption in the UK rose from 497,000 tonnes to 636,000; steel consumption increased from 14,330,000 to 15,090,000 and wood and paper consumption more than doubled, from 41 million to 93 million **tonnes**.²⁰

This inexorable drive towards the creation of new commodities is perhaps the central drive in the history of capitalism; the physical production of material goods being the simplest way of deriving value from living labour. It is not, of course, the only way. There are profits to be made, for instance, from running private nursing homes, or contract cleaning agencies, from servicing computers, arranging conferences or organising rock concerts. However – partly because of the limitations on the extent to which human productivity in these areas can be enhanced by automation and the consequent dependence on a geographically fixed and skill-specific workforce – it is easier and in the long run more profitable to be in the business of manufacturing **and/or** distributing endlessly reproducible material commodities. Thus while most of the major opera houses in the world require a public subsidy to stay open, selling Pavarotti's Greatest Hits on CD is hugely lucrative. Similarly, commodified medicine, in the form of mass sales of patented drugs, seems likely to remain much more profitable than employing doctors and nurses. These products do, of course, 'contain' knowledge (in the first case in the form of the composer's score, the performance of the conductor, orchestra and singer, the skills of the

producer and studio engineers, the intellectual labour of the scientists and technicians who developed recording technology in general and CD technology in particular, and so on; in the second case *inter alia* in the form of inputs from doctors, scientific researchers and laboratory technicians). Except where this knowledge is paid for on a royalty basis, however, this can be **regarded** as 'dead' labour, whose cost is amortised in the early stages of production, producing a steadily increasing profit margin which grows with the size of the production run.

We can see, therefore, that in at least some parts of the service sector, the trend is one of materialisation, rather than dematerialisation. What of the others?

A second category of service activity could be classified as the development of human capital – the reproduction of the knowledge workforce itself. Into this category come education and training and some kinds of research and development. This sector is not immune from commodification – witness the standardisation of courses and the development of products such as interactive CD-ROM to deliver instruction. David Noble has **argued** that the introduction of intranets (a combination of computers linked together on an internal telecommunications network) into universities is ushering in a new era of commodification in higher education. In his words,

The major change to befall the universities over the **last** two decades has been the identification of the campus as a significant site of capital accumulation, a change in social perception which has resulted in the systematic conversion of intellectual activity into intellectual capital and, hence, intellectual property. There have been two general phases of this transformation. The first, which began twenty years ago and is still underway, entailed the commoditization of the research function of the university, transforming scientific and engineering knowledge into commercially viable proprietary products that could be owned and **bought** and sold in the market. The second, which we are now witnessing, entails the commoditization of the educational function of the university, transforming courses into courseware, the activity of instruction itself into commercially viable proprietary products **that** can be owned and bought and sold in the **market**.²¹

The content of these new commodities is abstract, in the sense that it has been abstracted from the lecturers, researchers and graduate students employed in this sector. Unlike past forms of commodified scholarship, such as text-books, these newer means of abstraction rarely acknowledge the authors' ownership by means of royalties. Nevertheless, **they** do not differ fundamentally from the process whereby the **design** of a carpet is abstracted from a skilled weaver and

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embedded in the programming instructions for an automated loom. What it is important to keep sight of here is that the workforce has not disappeared. Even if the more original and creative (and perhaps hence the most troublesome) workers could somehow be emptied of all the knowledge that their employers find useful and got rid of, a workforce – including original and creative people – would still be required, however deskilled and intensified the rest of the work process had become, to replenish the stock of intellectual capital, produce new educational commodities and administer the new standardised courses, in standardised doses, to the next generation of students.

The systematisation of education which has taken place in recent years bears a close resemblance to the systematisation of other forms of non-manual work. For instance, the way in which the assessment of students' work may be transformed from a mystified and subjective process of exercising individual professional judgement to the ticking of boxes on a standard marking scheme is not unlike the way a bank manager's assessment of a client's eligibility for a loan or mortgage increasingly turns on the administration of a standard questionnaire, with standard built-in criteria, in which the decision is effectively made by the software programme.

This sector, then, is one where enormous changes are taking place in the labour process (and, with it, the capital accumulation process) in association with the introduction of the new information technologies. It does not, however, appear to raise any new problems which are not soluble within the framework of the 'old' economics.

The third category of service activity is the one which most concerns Quah and the other economists of the 'weightless' school. This is the 'knowledge work' which is either directly involved in the production of physical commodities, or involved in the production of new commodities which are entirely weightless. In the former category, an oft-cited example is that of the fashion shoe, only a fraction of the price of which is attributable to the raw materials and the cost of physical manufacture and transport. The main value, it is argued, comes from the 'weightless' attributes of the shoe, derived from its design, its brand image, the way in which it is marketed and so on. As Diane Coyle puts it, the 'buyer is paying for what they do for her image rather than something to protect her feet'.²² Notwithstanding the extra money a purchaser is prepared to pay for a high-status product, it is still, at the end of a day, a material object which is being purchased, and from which the manufacturers derive their profit. The snob value of a Nike running shoe in the 1990s is not different in *kind* from that of a

sought-after Paris bonnet in the 19th century;" the main difference lies in the fact that the former is mass-produced while the latter was individually made. In the former case, the 'knowledge' has been abstracted from a specialist knowledge-worker in a reproducible form; in the second it lay embedded in the skill of the milliner whose bodily presence was thus required to produce each new bonnet.

The emergence of the specialist knowledge worker is thus a product of the increasingly specialised division of labour in *manufacturing*.²⁴ In this process, as the physical business of production becomes more and more capital-intensive, through automation, the manual processes of assembly become progressively deskilled, enabling the work to be done ever more cheaply. In the case of sports shoes, this is often by the use of extremely low-paid labour in developing countries. In 1995, for instance, it was reported that twelve thousand women were employed in Indonesia making Nike shoes, working sixty hours a week and many earning less than the *government's* minimum wage of US \$1.80 a day. It was estimated that raising their wages to US \$3.50 per day would still bring the labour cost component of a pair of shoes to less than US \$1 a pair. In 1993, by contrast, Michael Jordan alone received over US \$20 million from Nike for allowing his name and image (and by implication his sporting achievements) to be associated with their product – equivalent to more than the total labour cost for all the 19 million pairs of Nike shoes made in *Indonesia*.²⁵ Traditional economics allows us to understand the very small proportion of the cost of the final shoe attributable to the labour involved in its manufacture as the super-exploitation of a vulnerable group of workers; the 'new' economics simply renders them invisible. Yet it is difficult to see the division of labour in the production process as anything intrinsically new; rather it can be seen as the continuation of a process which has been evolving for at least the past century and a *half*.²⁶ Michael Jordan may be earning considerably more, but his contribution to the value of the final product is not different in kind from that of the little girls who posed for the Pears Soap advertisements at the turn of the century²⁷ or the members of the royal family who give their official blessing and the use of their coats of arms to pots of marmalade.

What is perhaps new is the large-scale introduction of new technologies not just into the process of production of commodities but also into their distribution. The creation of global markets for mass-produced commodities has generated imperatives to increase the efficiency of this distribution workforce and, indeed, to introduce entirely new ways of reaching potential customers and persuade them

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to buy. In some cases this has produced the rather paradoxical effect of **recreating** the illusion of a return to the customisation of products associated with the era before mass production. Thus, for instance, there are now web-sites into which you can input your measurements to enable you to order a pair of blue-jeans tailored to your own precise individual dimensions (provided, of course, you are prepared to select from a menu of standard styles from a single manufacturer). The computerisation of parts of the production process has been combined with the use of the new communications technologies to create a direct interactive link between customer and **producer**. This also has the effect of cutting out various intermediaries (such as the wholesaler and the retailer) and of reducing the manufacturer's risk of over-producing, or producing the wrong product, almost to zero: only that which has already been ordered by the customer need ever be produced. In this case, however, there is still a material commodity which has to be manufactured, packed, and delivered over real physical distances to its customer.

In other cases, the commodity being distributed is less easy to pin down in its material form. An example of this might be the use of a call centre for activities like selling airline tickets, providing directory enquiry information, arranging financial transactions, providing assistance on software problems or dealing with insurance claims. Again, the sophisticated use of new technology makes it possible to personalise these services, however remote the site from which they are delivered. Software can, for instance, be programmed to use the area code from which a call is originated to direct the caller to an operator who will reply in the right language or even the appropriate regional accent, thus creating an illusion of local response whatever the actual location or time zone. The same digital trigger (the caller's telephone number) can also be used to ensure that the caller's personal file is visible on the screen to the operator before the first 'hello' has even been uttered, making it possible to generate a highly personalised response and, indeed, an illusion of intimacy, as well as maximising the operator's productivity by avoiding any waste of time in taking down unnecessary details.

The use of computer-generated scripts which pop up on the screen to be read verbatim by the operator can reduce the skill requirements to a minimum. This sort of work is also amenable to a high degree of remote monitoring and control. Studies of call centre workers in the UK – already an estimated 1.1% of the workforce²⁸ in a market estimated to be growing at the rate of 32% per annum across Europe²¹-

have found that the work is **highly** controlled, relatively low-paid, frequently involves round-the-clock shift-working and produces a very **rapid** rate of staff turnover, with 'burn-out' typically occurring after 12 to 20 months on the **job**.³⁰ The evidence suggests that, far from constituting some new kind of knowledge worker, formerly unknown to economics, these are the **Taylorised**, deskilled descendants of earlier forms of office worker (such as bank tellers, insurance salespeople, booking clerks and telephone operators) even though the work may be taking place at different locations and under different conditions of employment. There seems to be no good reason why the value which they add to the products or services being delivered (which may, or may not, be of a tangible nature) **cannot** also be measured by the traditional means.

This **brings** us to the other kind of knowledge work in this category discussed in the 'weightless economy' literature – the kind which produces no material end-product whatsoever. This may take the form of algorithms (such as a software program), intangible financial products (such as a life insurance **policy**), creative works (such as a film script) or speculations (such as an investment in futures). Again, none of these is new in itself: a musical score, the perforated roll of paper which contains the 'instructions' for a **pianola**, a chemical formula, the blueprint for a machine or indeed a recipe book, represent essentially the same kind of algorithm as a computer program, for example. And various forms of gambling, usury and insurance seem to have been around for as long as money. In the seventeenth century, one of the earliest uses of official statistics (in this case the London *Bills of Mortality*, from which the merchant John Graunt constructed life expectancy tables) was for the calculation of **annuities**.³¹ And writers, poets, dramatists, visual artists, scientists, inventors and musicians have been **producing** 'intangible products' for centuries. When we read of rock musicians borrowing money on the world's stock markets against their future royalty earnings this may seem like some new semi-magical way of generating income out of thin air, but is it really very different from the way in which impecunious young aristocrats in the 18th century settled their **gambling** debts by the use of **IOUs** drawn against their future inheritance? Danny **Quah** argues that weightless products **defy** the traditional laws of economics because **they** are simultaneously infinitely expandable, indivisible and inappropriable. In other words a new idea can only be discovered once; once discovered it can not only be used over and over again without being 'used up', and even if there are formal restrictions, in the form of patents or copyright, on so doing

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it can in practice be freely reproduced.³² While it is certainly true that the new communications and reproductive technologies have made the rapid dissemination of ideas easier than ever before, this again does not appear to be a new phenomenon. Surely these features have always been present when new discoveries have been made (such as the use of penicillin to heal infection, or the theory of gravity, or the discovery of electricity)? And the copying of ideas is as old as the history of fashion.

It is possible to argue about the exact relationship of these abstract products to material reality. In some cases they may act as proxies for material goods (as in the case, for instance, of a mortgage, which can be exchanged for a house, or an insurance policy which can be exchanged for a new car or indeed a credit card transaction which can be exchanged for goods or cash). In other cases (for instance in the case of a piece of music or a poem) it is more useful to envisage them in relation to the human desires they satisfy.

If we are to avoid constructing a purely abstract universe, constituted entirely of 'knowledge' (in which disembodied entities inhabit a virtual space, are sustained by virtual inputs, and produce virtual outputs – a universe without birth or death, a universe where infinite consumption is possible without the generation of waste), it is useful to retain an awareness of this underlying materiality. From an economic perspective, I would argue, it is important to retain a more specific awareness of the materiality of the worker and his or her labour process. It is only by examining this process in some detail that it becomes possible to tease out the specific contributions made at each stage to the 'value' of the final commodity. Such an analysis can also illuminate the process which Marx identified whereby labour is progressively abstracted and incorporated into capital in its specific relation to 'knowledge' work in an economy increasingly dependent on the use of information and communications technologies.

In brief, we could say that in the 1990s the division of labour has evolved to a point where a substantial part of the labour force is engaged in 'non-manual' work; is, in other words, engaged in the generation or processing of 'information' (even though this work nevertheless involves the body in a series of physical activities, such as pounding a keyboard, which have implications for its physiological well-being). The development of computing technology has made it possible for this information (or 'codified knowledge', as it has been conceptualised by David and Foray³³) to be digitised and for some aspects of its processing to be automated, and the development of telecommunications technology has enabled this digital information to

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be transmitted from one place to another with great rapidity and at very low cost. These technologies in combination have made it possible for many of these processes to be standardised, as a result of which it has become possible for the workers to be monitored by results, and for the task to be relocated to any point on the globe where the right infrastructure is available together with a workforce with the appropriate skills.

We must now ask ourselves what, precisely, is the relationship of this workforce to capital? How is the value of the final commodity constituted? In relation to its material content, Marx has already given us the answer: there is the dead labour of past workers embodied in the machinery used to make it, and in the extraction of the raw materials and the capital used to set the enterprise up, and the appropriated living labour of the workers who process it. In relation to the intangible content, there is also the dead labour of the people whose past work made the idea possible; but there is also **living** labour in two quite distinct **forms**.¹⁴ The first of these is the routine labour of deskilled workers who are essentially following instructions. We might call these 'process' knowledge workers. These may be involved either in the production process (for instance coders working on the development of **software**, graphic designers laying out web pages, copy-typists inputting data, managers supervising the purchasing of raw materials or the organisation of the production process, quality controllers checking the final output) or in the distribution process (such as call centre staff or invoice clerks). Although when it is casualised some form of payment by results (or piece-rate) may be applied, it is normally paid **by** time, as is the case with manual work. Even if the activity is outsourced, the wage or salary bill is verifiable and it is thus a relatively **straightforward** task to relate these labour costs to the output in order to calculate the value added.

Then there is also another kind of knowledge work, which we might call 'creative' or 'originating' labour (some of which may be contributed, with or without acknowledgement, by the 'process' workers) which generates new intellectual capital, in the form of ideas, designs, programs or more definable (if not tangible) intellectual products such as words, music or images. The contribution made by this work is harder to calculate. The ideas may be appropriated from a waged workforce (in most countries, ownership of intellectual property produced by employees is automatically assigned to the employer). However **they** may be **produced** by freelancers or other independent individuals or organisations under agreements which assign all or part

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of the ownership of rights to the creator. In such cases, the right to use the intellectual product may involve the payment of fees or royalties or the negotiation of complex licensing agreements. Alternatively the ideas may simply be stolen. Intellectual property rights can be legally asserted not just in the outputs of workers who are conscious of their roles as generators of valuable ideas, for instance as writers, artists or inventors. They also apply to the tacit knowledge of people who have no awareness of the alienable nature of what they own. The music of tribal peoples, for instance, may be appropriated to be used on CDs or film soundtracks; their visual art may be photographed and printed on tee-shirts or wrapping paper, or scanned in to give an 'ethnic' feel to the design of a web page; their sacred artefacts may be used as 'inspiration' for a new range of designer clothes or jewellery. It does not stop there: supermarkets developing 'own range' 'ethnic' convenience foods will generally insist that the subcontractors who prepare the food for them ~~give~~ give them an exclusive **right** to use the recipe; the handed-down knowledge of the family or community thus becomes appropriated as privately-owned intellectual **capital**.³⁵ Even more extreme is the patenting of human genetic codes for research purposes, a development of the practice of patenting the DNA of various plants and animals (with a slight tweak to ensure its uniqueness) for use in new drugs and genetic engineering **products**.³⁶

It is no accident that the ownership of intellectual property is currently one of the most hotly contended issues both at the level of international trade agreements and at the level of workplace negotiation. In the UK, for instance, the National Union of Journalists has found itself in recent years in a series of disputes with large employers over the right of freelance journalists and photographers to retain ownership of copyright in their own work. Many employers, including the supposedly left-of-centre Guardian newspaper, now make it a condition of employment that all rights, electronic or otherwise, become the property of the **newspaper**.³⁷ On one level, this can be regarded as a simple dispute between labour and capital, with workers fighting for a larger share of the products of their labour. However the concept of ownership is rather different from that which pertains in a typical factory. It is now over two centuries since workers effectively gave up their right to a share in the ownership of the product of their labour in return for a wage. The knowledge worker who insists on a royalty, or on the right to re-use what **s/he** has produced, is not behaving like a member of the proletariat; **s/he** is refusing alienation.

Nevertheless, the worker's right to ownership of the 'idea' (as

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opposed to the **right** to be **paid** for the time put in on the processing of that idea) is **profoundly** ambiguous. The knowledge worker usually occupies an intermediate position in what might be seen as the knowledge food chain. Ideas do not come from nowhere: they may be copied, consciously or unconsciously, from others; they may draw on what has been learned from teachers, or from books, or from observations of people who do not regard themselves as creative; or they may have arisen from the interactions of a group of people working together as a team. A journalist or television researcher generally obtains inputs from interviews with 'experts' (who may or may not be salaried academics or writers with an interest in plugging their books); there is no rational basis for deciding whether the end result should 'belong' to the journalist's employer, the journalist, the 'expert', or someone further down the chain, for instance the 'expert's' research assistant, or a person interviewed by the research assistant in the course of carrying out the research, or indeed the parents of the person interviewed by the research assistant who inculcated the views expressed in the interview. An analogous intermediary position could be said to be occupied by the scientist doing research on disease resistance in rice who obtains information from South-East Asian peasants as part of the process which eventually leads to his or her employer registering a claim to ownership of the new strain which is developed; or by Neil Simon incorporating tribal music into 'his' work; or by the photographer who records the face of an elderly Jamaican fisherman to use to advertise a canned drink.

In the final analysis it is market strength which determines who can claim what share of the cake, but the analysis of how the 'value' is formed is complicated by these considerations. The fact that it is complicated to model does not render the task impossible. In order to do so, it is necessary to take account of the fact that real people with real bodies have contributed real time to the development of these 'weightless' commodities.

This brings me to the second issue which occupies such a large place in the weightless economy literature: the so-called 'productivity paradox'. The starting point for this discussion is the belief that growth rates, measured in GDP (gross domestic product) and TFP (total factor productivity) have in most developed countries remained obstinately low since 1973 – well below their post-war levels up to that date. This year is chosen as the watershed partly because it was in 1973 that the oil crisis generated a number of dramatic hiccups in the economic statistics, and partly because it more or less coincided with the **begin-**

nings of what has been variously described as the 'knowledge economy', the 'information economy', the 'second industrial revolution' or the 'computer revolution'. If, as is widely argued on both the **left** and the right of the political spectrum, the introduction of these new technologies can unleash human potential, making workers more productive and creating a host of new products and services, then this ought to have led to a surge in economic growth. The apparent evidence that it has not done so is one of the main factors leading to the belief that a new economics is required. However the paradox may not be as surprising as it first appears.

First, the evidence itself: productivity is normally measured by the relationship between the value of outputs and that of the inputs of labour and capital. As Danny Quah has pointed out, if we are to judge by the statistics alone, the most productive group of workers in the world are French **farmers**.³⁸ The implication is that apparently high productivity can simply be an effect of artificially high prices of final outputs. This suggests that part of the explanation for the 'productivity paradox' may lie in the very sharp reduction in prices which has accompanied the process of computerisation.

But do the empirical data support this definition of the problem? In this connection, **Neuburger** has convincingly shown that although there was a sharp drop in output, labour productivity did not exhibit a correspondingly sharp fall, and in some OECD countries did not fall significantly at all.³⁹ Moreover for the UK he has also shown that the **present system** of public accounts would only reveal the kind of productivity gains delivered by information technology in about ten percent of the sectors comprising the total **economy**.⁴⁰ Nonetheless a paradox does seem to exist, even if not in nearly as extreme a form as generally supposed. So what **might** be the explanation for it? Is political economy really incapable of providing one?

Here, I can **only** indicate some of the main possible solutions to the puzzle out of the many which have been proposed. One has to do with the effects of globalisation. It is very difficult for nationally-based systems of accounting to deal accurately with the transactions taking place in a globalised economy. Where high levels of output are recorded in one country, but some of the inputs may have been in the form of very cheap labour in another, and complex adjustments have to be made to allow for such factors as fluctuating exchange rates and transfer pricing practices within large transnational companies, then some slippage may take place which affects the GDP figures positively or negatively.

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There are also many ways in which the extra productivity produced by information technology may not reveal itself in output figures. It may increase the efficiency of **unpaid** rather than paid labour, for example by **making** it much quicker and easier for a library user to **identify** a book, or a customer to withdraw cash from a bank. To the extent that information technology encourages the development of self-service this will not be reflected in the figures. It could be argued that a firm which improves its service to customers will thereby gain market share and that this will ultimately feed through into increased output figures, but this does not take account of the **generalised** effect which takes place when the whole sector has adopted this new technology; customer expectations will have risen but no single firm has a competitive advantage. Jeff **Madrick** has, in addition, raised a number of other technical issues, including a possible oversupply of services, that may have affected the statistics in the **USA**.⁴⁹

There are also very specific problems here associated with the public sector: **improvements** in efficiency and quality of service resulting from the introduction of new technologies into public administration or the delivery of public services may well lead to a better quality of life but this will not be reflected in the output **figures**, since national accounts do not at present capture in any direct way things like cleaner air, healthier children, happier cyclists or less confused form-fillers. It is sometimes argued that the nature of Britain's publicly-funded National Health Service creates a consistent bias in the national accounts leading to an underestimation of **GDP**.

A study of the public sector also raises some more fundamental questions relating to the socialisation of domestic labour (discussed above in the context of service employment). Part of the apparent fall in productivity from the 1970s onward might be a direct effect of the greater labour force participation of women during that period, and hence an increase in the need for a market supply of childcare and other services previously provided in the **home**.⁵⁰ A group of Norwegian researchers used a social accounting framework to decompose **GDP growth** into productivity gains and 'reallocation' gains resulting from the transition from unpaid household production to the labour market. **They** concluded that 'about one-fourth of the growth in GDP in Norway over the **period** 1971-90 can be attributed to the transition of household services from unpaid to paid **work**'.⁵¹

Neuburger's own explanation for the 'productivity paradox', insofar as it exists, is an interesting one. He **hypothesises** that during the 1970s there was a qualitative improvement in working conditions across most

of the OECD countries and that the increased cost of inputs (reflected in **lower** productivity growth figures) represented a real gain for labour, in the form of improved health and safety at work, a better working environment, longer holidays and other achievements. In most developed countries, 1970-76 was, after all, as well as being a time of considerable trade union militancy, the period in which equal pay, protection against discrimination, maternity rights, protection against unfair dismissal, the right to a safe working environment and a number of other **rights** were, at least formally, enshrined in employment protection or anti-discrimination legislation. Although much of the legislation was difficult to implement and many workers fell through the net it did, according to **Neuburger**, lead to some measurable redistribution from capital to labour, and the productivity figures provide the evidence for it.

These issues of productivity and **growth** are, then, evidently complex; but we can at least conclude that they cannot be understood in relation to technology alone, but must be analysed in their full social and historical context.

A third strand in the discussions about the weightless economy concerns globalisation. Perhaps one of the most dangerous illusions fostered here is the notion that the new information technologies mean that anything can now be done by anyone, anywhere: that the entire population of the globe has become a potential virtual workforce. The issue of globalisation is crucial because it raises very directly the question of how the virtual economy, insofar as it exists, maps on to the physical surface of the globe we inhabit.

Although it is full of euphemistic descriptions of the 'death of distance' or the 'end of geography', the literature on the subject is surprisingly short on empirical **evidence**.⁴⁴ At one extreme, sceptics such as Paul Hirst and Grahame Thompson go so far as to assert that a global economy cannot be said to exist in any meaningful sense, and even **maintain** that the world economy is somewhat *less* global now than it was before the first world **war**.⁴⁵ At the other extreme is a large literature, much of it by postmodernist geographers, which takes the presumption that globalisation is taking place as its starting point, and is concerned to develop an understanding of the social, cultural and economic implications of this. The empirical evidence on which it draws is, however, **slight**, rarely going beyond the anecdote or case-study writ **large**.⁴⁶ Few systematic attempts have been made to establish the scale of relocation of **information-processing** work across national **boundaries**.⁴⁷

It is in fact extraordinarily difficult to obtain a statistical picture of the changing international division of labour. Apart from the difficulty of distinguishing between final outputs and intermediate ones, the traffic in jobs will not necessarily even appear in an easily identifiable form in the trade statistics, because of the range of different contractual arrangements which might apply, each of which is visible in a different way in the national accounts. Material goods must be transported in a physical form across national boundaries, and are therefore generally recorded in import and export statistics; but information sent over the internet leaves no such trace and there is no easy way to assess the value of such traffic. It is, of course, possible to measure its *volume* but, despite the arguments of Luc Soete and others who propose a 'bit tax',⁴⁸ this is not a good indicator of value: a computer program which has taken thousands of skilled person-hours to write will typically be much smaller in volume (measured in bits) than a video clip or scanned-in photograph in whose generation only a few moments of unpaid time have been invested.

The fact that **something** is difficult to measure does not, of course, mean that it does not exist, and it is clear that the widespread use of computers for processing information, and of telecommunications for transmitting it, has introduced an enormous new range of choices in the location of information-processing work.

However it would not be correct to infer from this that these choices are entirely untethered from the material. First, and most obviously, they depend on a physical infrastructure. The process which was formalised in the liberalisation of the telecommunications market following the ratification of the World Trade Organisation pact of 15 February 1997 by 68 countries has opened up most of the world as a market for the major telecommunications multinationals and involved a rapid spread of infrastructure and a sharp fall in telecommunications costs. But this process has been highly selective; it certainly cannot be said to have given all the world's population access to the 'information society'. In many developing countries whole communities are effectively without any telephone access whatsoever and even those lines which exist are of poor quality. The optical fibre cable which is required to transmit high volumes of information quickly, and which provides a vital underpinning for many 'weightless' activities, is so far only available in selected parts of the globe, mainly in large cities, such as Singapore, where high usage, and hence profitability, is anticipated.

Even 'wireless' communications are dependent on material **goods**, like satellites, to continue functioning On May 20th, 1998,

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Americans were reminded sharply of this when there was a malfunction in the **onboard** control system and a backup switch of the Galaxy IV satellite, owned by **PanAmSat**. The satellite reportedly provided pager service to more than 80% of US pager users, and also carried NPR, several television networks, and Reuters news feeds. Whilst CBS services were **quickly** switched to **Galaxy 7**, pager users, including many hospitals, were left without any **service**.⁴⁹

Telecommunications infrastructure is not the only material prerequisite for participation in the **global** weightless economy. There is also a need, continuously renewed because of its rapid obsolescence, for hardware: for personal computers, mobile telephones, modems, scanners, printers, switches and the many components and accessories involved in their manufacture and use. Not only do the costs of these differ in absolute terms from country to country, but so does their cost relative to basic income and subsistence. Mike Holderness has pointed out that 'a reasonable computer costs about one year's unemployment benefit in the UK or about the annual income of three schoolteachers in Calcutta' and that the annual subscription to Ghana's only internet host is about the same as the entire annual income of a Ghanaian **journalist**.⁵⁰

The notion that anyone can do anything anywhere is therefore in practice constrained by a number of spatial factors. It is also, of course, constrained by the fact that not all human activities are delocalisable in this way. **The** majority of jobs are, and seem likely to remain, firmly anchored to a given spot, or series of spots, on the world's surface because they involve the extraction of the earth's raw materials, their processing, the manufacture of material commodities (which is delocalisable, but within limits), transport, construction, or the delivery of physical services (ranging from health care to garbage collection).

That said, it is undeniably the case that more and more work is delocalisable. The reasons for this are many. First, there are the changes in the division of labour which have increased the proportion of jobs which simply involve processing information. Second, the digitisation of that information has vastly increased the extent to which it can be accessed remotely, removing the need for physical proximity to sources and eliminating transport costs. Third, the standardisation of tasks associated with computerisation has enabled a growing proportion of activities to be monitored remotely (replacing management of the work process with management by results) which in turn allows them to be outsourced or located at a distance from the manager. Fourth –

partly because of the **hegemonic** power of companies like IBM and Microsoft – there has been a convergence of skill requirements across occupations and industries, with a few generic skills (such as a knowledge of Word or Excel) replacing a **large** number of machine-specific, firm-specific or occupation-specific skills which have in the past both constrained the mobility of workers and created a dependence on their skills among employers, effectively anchoring them to the places where those skills were available. Fifth, as already noted, there has been both a rapid diffusion of the infrastructure and technology and a sharp fall in its **cost**.³¹

This should, in principle, have enabled any region in which the right combination of infrastructure and skills is present to diversify its local economy and enter the global market in information-processing work on an **equal** basis with any other region. By removing the strategic advantages of some regions (created by such things as economies of scale or proximity to markets) it should have levelled the playing field. It is this idea which underlies much of the optimistic rhetoric about the ability of new information and communications technologies to regenerate remote regions. However the results of empirical research reveal that **things** are not so simple. The very fact that employers now have a huge range of alternative locations to choose from appears, paradoxically, to have increased, rather than decreased, the degree of geographical segregation in the global division of labour. Although its specific components may have changed, comparative competitive advantage is more, rather than less important, with each location having to compete separately for each type of activity. No **longer** constrained to have most of their information processing activities on one site, corporations are now free to seek out the best location on an activity by activity basis, with the whole world to choose from. Thus a company might decide to get its **manufacturing** done in Mexico, its research and development in California, its data entry in the Philippines, its software development in India and establish two call centres, one in New Brunswick, Canada, and one in the Netherlands. In each case, the site would be selected on the basis of the availability of skills and the advantageousness of other local labour market conditions, tax regime, etc. If the market **became** more competitive, or local workers started demanding **higher** wages or better conditions, or the local tax regime changed, it might switch: it might, for instance, go to Indonesia for manufacturing, to the Dominican Republic for data entry, to Russia for programming or start using homeworkers for some of the more routine call centre functions. Even within countries, this

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increasing geographical specialisation (generally accompanied by polarisation in incomes and standards of living) can be observed. Some recent research I carried out in the UK revealed a steadily growing gap between those regions which were successful in attracting high-skilled 'creative' knowledge work (mostly concentrated in an affluent 'green' corridor to the west of London) and those which had succeeded only in attracting routine back-office functions and call centres (almost exclusively in declining industrial areas).¹² Remote rural areas with poor infrastructure had failed to attract either type of employment.

Such findings cast serious doubt over many of the claims made by economists of the 'death of distance' school. They suggest that location has actually become more rather than less important. Some places seem likely to be able to build on their comparative advantages to increase the gap between themselves and the rest of the world; others seem likely to be able to find niches for themselves in the new global division of labour, by exploiting things like language skills, time zone advantages, cheap labour, **specialist** skills, or **good** infrastructure; still others will be left entirely out in the cold. The dream of a **fully** diversified local economy in any given area seems likely to remain unrealisable except for a few privileged pockets.

And what of the future of knowledge work? It seems likely that two existing tendencies will **intensify**. On the one hand, there is likely to be a continuing erosion of the traditional bureaucracy (as first anatomised by **Max** Weber at the beginning of the century) with its stable hierarchies, rigid rules, orderly – if implicitly discriminatory – promotion patterns, 'jobs for life', process management and unity of time and space, in favour of an increasingly atomised and dispersed workforce, managed by results, insecure and expected to work from any location. If they are not actually formally self-employed, this group of workers, which will include a high proportion of the 'creative' knowledge workforce, will increasingly be expected to behave as if they are. On the other hand, there is likely to be the creation of what is in effect a new white-collar proletariat engaged in the more routine 'process' knowledge work, closely monitored with Taylorised work processes and stressful working conditions. Geographical segregation will make it difficult for members of the second group to progress to the first.

The geographical distribution of intellectual labour (the movement of jobs to people) is only one aspect of **globalisation**, of course. In analysing the forms of capital accumulation which prevail as the century draws to a close it is also important to look at the global division of labour in terms of the physical movements of migrant

workers (the movement of people to jobs) and in terms of the development of mass global markets.

In order to do so, however, it is not necessary to develop a new economics of weightlessness. On the contrary, we must reinsert human beings, in all their rounded, messy, vulnerable materiality – and the complexity of their antagonistic social relations – at the very centre of our analysis.

NOTES

- 1 Frances Cairncross, *The Death of Distance: How the Communications Revolution will Change our Lives*, Harvard Business School Press, Boston, 1997.
- 2 Diane Coyle, *Weightless World: Strategies for Managing the Digital Economy*, Capstone Publishing, Oxford, 1997.
- 3 Christopher Meyer and Stan Davis, *Blur: the Speed of Change in the Connected Economy*, Addison-Wesley, South Port, 1998.
- 4 Don Tapscott (ed) *Blueprint to the Digital Economy: Wealth Creation in the Era of E-business*, 1998; Don Tapscott, *The Digital Economy: Promise and Peril in the Age of Networked Intelligence*, McGraw Hill, New York, 1995.
- 5 Dale Neef (ed) *The Economic Impact of Knowledge (Resources for the Knowledge-based Economy)*, Butterworth-Heinemann, Boston, 1998.
- 6 Bob Norton and Cathy Smith, *Understanding the Virtual Organization*, Barrons Educational, Hauppauge, N.Y., 1998.
- 7 In doing so, I have been helped immeasurably by discussions with the economist Henry Neuburger who has brought more sceptical rigour to these questions than anyone else I know. He is not responsible, of course, for any inadequacies in my arguments, for which I take full blame.
There is some encouraging evidence that this may have peaked, and that the old modernisms are beginning to reassert themselves. Nevertheless, we now have several generations of students already in or about to enter the intellectual labour market who have been taught to view the world through postmodernist lenses, and whose practices will be influenced by these views.
The critical realism of Roy Bhaskar seems to offer the most promising way forward currently on offer – see Roy Bhaskar's own *A Realist Theory of Science*, 1975, republished by Verso Books in 1997 (Verso Classics 9) and *Dialectic: The Power of Freedom*, Verso Books, London, 1997; Andrew Collier, *Critical Realism: An Introduction to Roy Bhaskar's Philosophy*, Verso Books, London, 1994; and the interesting discussion of Bhaskar's work in Meera Nanda, 'Restoring the Real: Rethinking Social Constructivist Theories of Science' in Leo Panitch (ed.), *Socialist Register, 1997*, Merlin Press, Rendlesham, 1997.
- 10 Jean Baudrillard, *Simulacra and Simulation (The Body, in Theory: Histories of Cultural Materialism)* translated by Sheila Faria Glaser, University of Michigan Press, Chicago, 1995.
Donna J. Haraway, *Simians, Cyborgs, and Women: The Reinvention of Nature*, Routledge, London and New York, 1991.
- 12 Email address: weightlesseconomy.com.
- 13 Danny T. Quah, 'Increasingly Weightless Economies' in *Bank of England*

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Quarterly Bulletin, February, 1997, p. 49.

- 14 Daniel Bell, *The Coming of Post-Industrial Society*, Basic Books, New York, 1973.
- 15 I do not have the resources while writing this article to demonstrate this conclusively on a national scale. However in 1979-80, with the invaluable help and guidance of Quentin **Outram**, I carried out a detailed study based on data **from** the decennial Censuses of Employment supplemented in more recent years by data from Census of Employment, of service employment by occupation and industry (i.e. including those 'service' workers whose employers were categorised in 'manufacturing' or other non-service sectors) in one part of Britain – West Yorkshire. While doing this work – which focused particularly on women's employment – we were **greatly** struck **by** the almost exact parallel between the decline of domestic service and the expansion of other forms of service employment between 1901 and 1971. The report, which was published under the title *The Impact of New Technology on Women? Employment in West Yorkshire*, by Leeds Trade Union and Community Resource and Information Centre, 1980, did not, unfortunately, draw attention to this finding.
- 16 C.H. Lee, *British Regional Employment Statistics, 1841-1971*, Cambridge University Press, Cambridge, 1979.
- 17 Gøsta Esping-Andersen, *The Three Worlds of Welfare Capitalism*, Polity Press, Cambridge, 1990.
- 18 First in Ursula Huws, 'Domestic Technology: liberator or enslaver?' in *Scarlet Women*, No 14, January 1982, reprinted in *Sweeping Statements: Writings from the Women? Liberation Movement* 1981-1983, eds Kanter, Lefanu, Shah and Spedding, The Women's Press, London, 1984; then in Ursula Huws, 'Challenging Commodification', in *Very Nice Work If You Can Get It: The Socially Useful Production Debate*, Spokesman, Nottingham, 1985. The argument is summarised in Ursula Huws, 'Consuming Fashions', *New Statesman & Society*, August 1988 and, most recently, in Ursula Huws, 'What is a Green-Red Economics?: the Future of Work' *Z*, September, 1991.
- 19 Tim Jackson, *Material Concerns - Pollution, Profit and Quality of Life*, Routledge, London, 1996.
- 20 Department of the Environment *Digest of Environmental Statistics*, information supplied by Friends of the Earth.
- 21 David Noble, 'Digital Diploma Mills: The Automation of Higher Education', article distributed on the internet with the author's permission by the Red Rock Eater News Service (pagre@weber.ucsd.edu), October, 1997.
- 22 Diane Coyle, 'Why knowledge is the new engine of economic growth', *Independent*, 23 April 1998.
- 23 I am indebted to James Woudhuysen for this comparison.
- 24 Harry Braverman's *Labour and Monopoly Capital: the Degradation of Work in the Twentieth Century*, Monthly Review Press, New York, 1974 remains the classic account of this process.
- 25 'There is No Finish Line – Running Shoes: the Follow-Up', *News from Irene*, Issue No 22, March, 1995, pp. 33-36.
- 26 The publication of Charles Babbage's *On the Economy of Machinery and Manufactures* in London in 1832 is as convenient a starting point as any to select for the systematic and conscious introduction of processes designed to reduce labour costs in **manufacturing** to a minimum.
- 27 Selected annually in a 'Miss Pears' beauty contest which continued certainly up

- to the 1950s, when I was a child, and quite possibly for many years afterwards.
- 28 Sue Fernie and David Metcalf, 'Hanging on the Telephone', in *Centrepiece: the Magazine of Economic Performance*, Vol 3, Issue 1, Spring, 1998, p. 7.
- 29 Research by Datamonitor, quoted in Una McLoughlin, 'Call centre staff development' in *T*, October, 1997 pp. 18-21.
- 30 Incomes Data, *Pay and Conditions in Call Centre*, IDS Report 739, June, 1997, Geraldine Reardon, G. 'Externalising Information Processing Work: Breaking the Logic of Spatial and Work Organisation', United Nations University Institute for New Technologies Conference on *Globalised Information Society: Employment Implications*, Maastricht, October 17-19, 1996; and Sue Fernie and David Metcalf, 'Hanging on the Telephone', in *Centrepiece: the Magazine of Economic Performance*, Vol 3, Issue 1, Spring, 1998.
- 31 Martin Shaw and Ian Miles, 'The Social Roots of Statistical Knowledge' in John Irvine, Ian Miles and Jeff Evans (eds) *Demystifying Social Statistics*, Pluto Press, London, 1981, p. 30.
- 32 Danny Quah, 'Policies for the Weightless Economy', Lecture to the Social Market Foundation, London, April 21, 1998.
- 33 David and Foray, 1995, incompletely referenced citation in Luc Soete, 'The Challenges of Innovation' in *IPTS Report 7*, Institute for Prospective Technological Studies, Seville, September, 1996, pp. 7-13.
- 34 Luc Soete distinguishes three forms in which knowledge becomes embedded in a commodity (or, in his language 'contributes to growth') These are 'easily transferable codifiable knowledge', 'non-codifiable knowledge, also known as tacit knowledge (skills)' and 'codified knowledge'. See Luc Soete, 'The Challenges of Innovation' in *IPTS Report 7*, Institute for Prospective Technological Studies, Seville, September, 1996, pp. 7-13. This typology is extremely useful for analysing the components of value added but less so for keeping the labour process in focus.
- 35 This is certainly the practice in the West London district of Southall, which houses a large population from the Indian subcontinent and one of whose major industries is the preparation of curries and other Indian foods for British supermarket chains. See Ursula Huws, *Changes in the West London Economy*, West London Training and Enterprise Council, 1992.
- 36 The excellent bi-monthly *GenEthics News: Genetic Engineering, Ethics and the Environment*, chronicles new instances of this in every issue.
- 37 This is documented in the National Union of Journalists' monthly magazine, *The Journalist*.
- 38 Danny Quah, 'As Productive as a French Farmer', *Asian Wall Street Journal*, September 29th, 1997.
- 39 Henry Neuburger, 'Thoughts on the Productivity Paradox', unpublished paper, undated, p. 1. Arguing that measurement of total factor productivity is circular, he selected labour productivity as providing a more robust indicator.
- 40 Henry Neuburger, *loc. cit.*, p. 9.
- 41 Jeff Madrick, 'Computers: Waiting for the Revolution' *The New York Review of Books*, March 26th, 1998.
- 42 Sue Himmelweit, discussion of ONS Households satellite accounts, Royal Statistical Society, November, 1997, quoted in Henry Neuburger, 'Thoughts on the Productivity Paradox', *loc. cit.*
- Ilulie Askalen, Olav Bjerkholt, Charlotte Koren and Stig-Olof Olsson, 'Care work

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in household and market: **Productivity**, economic ~~growth~~ and welfare', paper submitted to the IAFFE-sponsored session at the ASSA meeting, Chicago, **3-5** January, **1998**. I am indebted to Sue Himmelweit for bringing this **important** research to my attention. Henry Neuburger has partially tested this hypothesis in the UK by modelling – in the form of household satellite accounts – two areas of activity, childcare and catering, using both input and output measures. He concluded that 'conventional GDP by omitting unpaid child care understated growth in the **1960s** and overstated it in the **1970s**. See Henry Neuburger, 'Modifying GDP', unpublished paper, undated, p. **2**. For an interesting discussion of the development of satellite accounts and social accounting matrices, see Neuburger, 'Measuring Economic Activity', unpublished paper, undated. The evidence is clearly complex and contradictory, but such studies do point up the incomplete picture gained from the **conventional** accounting procedures.

44 I have discussed this literature at some length in Ursula Huws, *Teleworking: an Overview of the Research*, Joint publication of the Department of Transport, Department of Trade and Industry, Department of the Environment, Department for Education and Employment and Employment Service, London, July, **1996**; and Ursula Huws 'Beyond Anecdotes: On Quantifying the Globalisation of Information Processing Work', United Nations University Institute for New Technologies Conference on *Globalised Information Society: Employment Implications*, Maastricht, October **17-19, 1996**.

45 Paul Hirst and Grahame Thompson, *Globalization in Question*, Polity Press, Oxford, **1996**, p. **27**.

46 I have discussed this problem in 'Beyond Anecdotes: on Quantifying the Globalisation of Information Processing Work', in *Globalised Information Society: Employment Implications*, United Nations University Institute for New Technologies Conference, Maastricht, October **17-19, 1996**.

47 I am currently engaged, along with the United Nations University Institute of Technology, in the design and implementation of a study which will, for the first time, provide reliable empirical evidence of the extent of **teleworking** and teletrade in services in Malaysia, with a sister study in Bombay.

48 Luc Soete and Karin Kamp, *The 'BIT TAX': the case for further research*, MERIT, University of Maastricht, **12 August, 1996**.

49 Richard I. Cook, MD, Cognitive Technologies Lab., Dept of Anaesthesia and Critical Care, University of Chicago, quoted in RISKS-FORUM Digest **19.75**, forwarded by Red Rock Eater News Service (pagre@weber.ucsd.edu), May, **1998**.

50 Mike Holderness, 'The Internet: enabling whom?, when? and where?', *The Information Revolution and Economic and Social Exclusion in the Developing Countries*, UNU-INTECH Workshop, Maastricht, **23-25 October, 1996**.

I have summarised these, and other related factors, in a number of publications including, Ursula Huws, *Follow-Up to the White Paper – Teleworking*, European Commission Directorate General V, September, **1994**, also published as *Social Europe, Supplement 3*, European Commission DGV, **1995**; Ursula Huws, *Teleworking: an Overview of the Research*, Joint publication of the Department of Transport, Department of Trade and Industry, Department of the Environment, Department for Education and Employment and Employment Service, July, **1996**; and Ursula Huws, 'Telework: projections', in *Futures*, January, **1991**.

52 Ursula Huws, Sheila Honey and Stephen Morris, *Teleworking and Rural Development*, Rural Development Commission, Swindon, **1996**.