INTRODUCTION TO 'THE AUTHOR AS (DIGITAL) PRODUCER'

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+ 'An author who has carefully thought about the conditions of production today [...] will never be concerned with the products alone, but always, at the same time, with the means of production. In other words, his [/her] products must possess an organising function besides and before their character as finished works.' (Benjamin 1983: 98)

Social change does not simply result from resistance to the existing set of conditions but from adapting and transforming the technical apparatus itself. Walter Benjamin in his essay 'The Author as Producer' (written in 1934) recommends that the 'cultural producer' intervene in the production process, in order to transform the apparatus in the manner of an engineer. This collection of essays and examples of contemporary cultural practices (the second in the *DATA browser* series) asks if this general line of thinking retains relevance for cultural production at this point in time - when activities of production, consumption and circulation operate through complex global networks served by information technologies. In the 1930s, under particular conditions and against the backdrop of fascism, a certain political optimism made social change seem more possible.[1] Can this optimism be maintained when technology operates in the service of capital in ever more insidious ways?

In referring to the activity of 'engineering', the term 'engineer' is to be taken broadly to refer to technical *and* cultural activity, through the application of

knowledge for the management, control and use of power. To act as an engineer in this sense, is to use power productively to bring about change and for public utility. In this, the traditional mechanical or electrical (hardware) engineer is evoked, but also the software engineer or software artist. Admittedly, there is little new in this; cultural production and engineering have been brought together in various ways – from the 'sci-art' work of Leonardo da Vinci to the 'experiments in art and technology' (EAT) involving the engineer Billy Klüver, working with John Cage and Robert Rauschenberg amongst others.[2] However, *Engineering Culture* attempts to draw together technical and cultural activity with the added desire for social change (invoking social engineering). It is important to strike a distance here from the popular view of engineering practice as merely a technical service industry: what The Institute for Applied Autonomy (IAA) herein call 'the tendency to myopically focus on technical problems and leave consideration of a product's ultimate use to marketers and end-users' (pp. 95-105). Clearly the aim is to evoke a less instrumental view of technology, that engages with the ethical and social implications of techno-cultural production in the material world. In the context of socially-engaged cultural practices of the 1930s, Benjamin stresses the counter-point that it is simply not enough for cultural producers to demonstrate political commitment without at the same time thinking through its relationship to the means of production and the technical apparatus. This is not to be interpreted as a preference for form over content, but a collapsing of the distinction between the two. For Benjamin (and Marxists in general), only in this way - through an engagement with the means of production and in turn the relations of production - can social change be made a possibility. This publication asks if this still holds, and if so, in what new forms?

On the surface, it seems that much contemporary techno-cultural practice operates in the spirit of Benjamin's essay, opposing the simplistic separation of theory and activism. Moreover (as we explored in *Economising Culture*, DATA browser 01), the separation of theorist and activist (and we might add 'artist' - although clearly there are difficulties with the term) makes no sense in an overall practice of cultural production that takes account of the cultural aspects

of economics and the economic aspects of culture. Clearly, the conditions and means of production have changed enormously since the 1930s. Capitalism has undergone dramatic transformations, characterised by flexibility, decentralisation and networking but there are also lines of continuity:
'The rise of the network society [...] cannot be understood without the interaction between these two relatively autonomous trends: development of new information technologies, and the old society's attempt to retool itself by using the power of technology to serve the technology of power' (Castells 1996: 52).

In much recent criticism addressing 'new' technologies, there is far too crude a distinction between industrial and post-industrial economies. In contrast, Manuel Castells, in *The Rise of the Network Society* (1996) describes the current technological mode as discontinuous from the industrial mode but its overall logic is continuous in serving power. The distinction (or alleged paradigm shift) that Castells points to, is the change in the ways technological processes are organised - from a mode of development focussed on economic growth and surplus-value (industrialism) to one based on the pursuit of knowledge and increased levels of complexity of information (informationalism). This publication aims to ask what new strategies might be appropriate, given these changes and the new emphasis on the production of knowledge and culture, rather than wealth. There may be discontinuities in terms of technological mode, but the site of production is still where inequalities are identified and where exploitative conditions might be reverse-engineered.[3]

Taking its cue from the opening Benjamin quote, this introduction firstly describes the changed material conditions of production that now concentrate on knowledge and information, and how labour has been reconceived as 'immaterial' (to characterise the way networked technologies materialise 'general intellect'). Consequently, some of the tensions over the proprietary ownership of ideas emerge that underpin creative strategies for engaging with the technical apparatus that is inherently collective and shared. In Benjamin's terms, cultural

production must be inserted into the context of lived social relations determined by production relations - and the cultural producer is required to act like an engineer accordingly. The contributions to this publication take this statement as a point of departure.

Upgraded technical apparatus

The logic of the network defines a new industrial space in contrast with the historically created institutions and organisations of industrial society, in which technological and organisational factors combine to make production flexible, able to produce goods across different locations but unified through networked communications technology. This is the 'post-industrial factory', defined not by a fixed site but by the network between multiple sites. Like a factory, the separate units are defined by the processes and labour required for the component parts of the overall operation. Networked communication technologies have contributed to this in requiring a highly skilled technological labour force on the one hand, and relatively unskilled assembly work on the other. Often this simply reflects the patronising terminology of the 'developed' and 'developing' world, in what Castells calls an international spatial division of labour, based on cheap labour costs, tax waivers and lack of environmental constraints, under the ruling ideology of neo-liberal globalisation (1996: 387).[4] With information technology, automation appears to have come of age, and 'developed' labour is transformed by the need for the required knowledge to operate it, offering new relational patterns in the performing of work. The increasingly immaterial form of social relations, communications networks and information systems has also been extended to the new type of production of 'immaterial goods' and - to use Maurizio Lazzarato's term - cast as 'immaterial labour' (1996). This can partly be recognised in relation to the computer, in the way it has redefined labour as well as the social relations that sustain Capital. Correspondingly, the argument follows that new forms of resistance are made possible by an understanding of these immaterial processes and apparatuses.

The continued significance of 'The Author as Producer' essay lies in requiring

the author or cultural producer to act as an active agent, to intervene in the production process and property relations; to transform the apparatus. This is the 'organising function' that Benjamin proposes, demanding the author reflect upon the production process - setting the laboratory in opposition to the finished work of art (or commodity form). If this now sounds like an orthodoxy in contemporary cultural practice, the crucial aspect for this argument is what Gabriel Tarde (in 1902) called 'truth-value' to theorise the production of culture and knowledge, and to undermine the traditional analysis of the political economy (Lazzarato 1999). Rather than concentrating on use-value, he introduced the idea of 'truth-value' because knowledge is the result of a process of production that produces value. However, unlike other products, knowledge is a mode of production that cannot simply be reduced to the market or through exchange without distorting its production and consumption value (1999: 160). His example is the production of books, in which the exchange value of a book can be determined by the market as a product but not as knowledge, which is more determined by moral issues of gift or theft (1999: 162). This publication might similarly be considered in such terms through its use of open license agreements and its contents freely downloadable from the internet. On the other hand, Capital desperately tries to treat knowledge as it does any other goods. It 'makes material the culture of the informational/global economy; it transforms signals into commodities by processing knowledge' (Castells 1996: 172). In Lazzarato's terms, Capital is obliged to turn 'immaterial products' into 'material products' to protect its logic - the logic of the 'immaterial economy', to use his term for the informational economy. Relations of power extend beyond the market in this way. If Capital appropriates knowledge and culture for its purpose, then its opposition must attempt to use knowledge and culture to influence the economy at the level of the *apparatus*.

Undoubtedly critical work on the nature of digital culture requires continual upgrade - proposing 'technical innovation and revolutionary use-value over mere modishness' as Benjamin puts it - in contrast to the 'naive optimism' of much new media practice. He further stresses that it is simply not enough for a

producer to have political commitment, however radical it may seem, 'without at the same time being able to think through in a really revolutionary way the question of their own work, its relationship to the means of production and its technique' (1983: 91). The problem of course, then and now, is that technical innovation and social engagement happen all the time but without putting relations of power into serious question. So what about the technical apparatus in contemporary terms of the knowledge and information economy?

A closer look at the contemporary operating system or apparatus highlights some contradictory tendencies in this respect. For example, in 'The Macintosh Computer: Archetypal Capitalist Machine?' (reprinted here with a new afterword, pp. 39-61), William Bowles argues that these tendencies of the capitalist system are not only enhanced by the development of new technologies but also expressed through the technological tools themselves. For Bowles (first writing in 1987), the Macintosh computer in particular represents a further development of what he describes as a 'general tool' for 'generalised education' in that it is designed to be easy to operate - to be 'user-friendly'. Despite surface appearances, however, the underlying processes are decidedly complex and there is a vast amount of expertise invested in the operating system. The operating system '"masks" the "real" operation of the computer by interposing itself between the user and the Central Processing Unit' and thus the Macintosh computer presents itself as a 'black box', denying access to its depths (to use a term from cybernetics). This is also symptomatic of current conditions of production, and arguably can be extended to describe wider mechanisms of knowledge production (through research and education) in the network society. The historical parallel of the introduction of new technologies can be traced to the beginnings of the industrial period, not least in the introduction of machine tools that transfer skills from the human to the machine itself, reflecting a trend that alienates the worker/user from the very processes they are involved in. For Bowles, this is entirely expected:

'What we are seeing is then an exact duplication of the first industrial revolution where craft skills were stolen and locked into the industrial machine, then

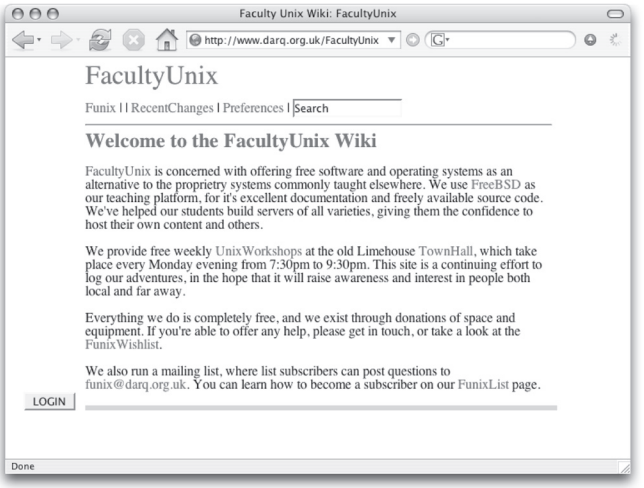
perfected to the point whereby general principles could be extracted and applied to ever more sophisticated machines, each in turn, requiring less and less skill (and labour) to operate!'

Reconceived forms of labour

Microsoft, the symbolic target of most negative attention in this field, provides opportunities for 'contingency workers' or 'temp slaves', as part of a 'disposable labour force'). Naomi Klein claims Microsoft 'wrote the operating manual' for this approach, 'engineering the perfect employee-less corporation' (2001: 249). Labour, including creative labour, is transformed by the need for the required knowledge to operate information technology, offering new relational patterns in the performing of tasks ('immaterial labour') and offering new patterns of exploitation. The phrase 'precarious labour' has become increasingly popular to describe intermittent and irregular work that 'teeters' on the edge of moral acceptability and the ability to generate a living wage. Flexibility in employment patterns necessitated by capitalist exploitation has created precarious conditions for workers, unions and perhaps even capitalism. For Marina Vishmidt, 'precariousness' stands for the 'ideological poverty of capital's subjectification, and hopefully, the site for a broadly-based contestation of its effects' (2005: 93). The 'immanence' in capitalism (that still contains the seeds of its own destruction) is based on the connection between the production of new subjectivities, the refusal to work, and the recomposition of workers as a class - related to the concept of 'immaterial labour'. In this scenario, the information worker is conflated with artist performing 'creative labour'; as Tarde says, 'artistic labour is productive labour' (Lazzarato 1999: 165). To Vishmidt, there is a danger in perpetuating the dogma of art or creativity, as well as the problem with the generality of the term immaterial labour, excluding certain forms of labour from the analysis, such as domestic work (2005: 94). Castells makes the distinction between the 'networkers' who set up connections on their initiative, and the 'networked' who are online but without any control over decisions; and another category of the 'switched-off', who are tied to tasks and operate through non-interactive, one-way instructions (1996: 244). For Lazzarato, the significance of this in terms

of intellectual production, 'is in the process of becoming a new "contradiction" within the information economy, for which the challenges represented today by the internet are but the premises of opposition to come' (1999: 163). However characterised, labour is still crucial for the identification of exploitation.

Elsewhere Tiziana Terranova argues that the complexity of labour in the digital economy is characterised by 'free labour' invested in the production of free and open source software (2000: 33). Drawing upon the idea of immaterial labour, she argues that there is a material foundation that structures the cultural and economic flows of the network society, reflecting free market principles. The contradictions over free labour are explained, for Terranova, not as an alternative to capitalism as such but as new forms of labour that 'developed in relation to the expansion of the cultural industries and are part of a process of economic experimentation with the creation of monetary value out of knowledge/culture/affect' (2000: 38). Clearly the knowledge to make free software is not free either. Although in some ways the Macintosh operating system's current Unix-based form (of OSX) makes it possible to work at a deeper level of operation through the command line interface (terminal), this is only the case if you have the knowledge and skills to do so. Such knowledge should be common property.



With this in mind, the University of Openness is an organisation that offers itself as a 'self-institution' for independent research, collaboration and learning.[5] Its Faculty of Unix is particularly interesting in this connection, offering free workshops as an alternative to proprietary systems and learning models elsewhere. This demonstrates the potential of open source knowledge as opposed to the ways in which conventional operating systems try to hide their complexity and hence limit the transformative possibilities.

In words that echo Lawrence Lessig's ideas in *Free Culture* (2004), that 'big media uses technology and the law to lock down culture and control creativity', Bowles's upgraded essay ends with the following statement: 'If the idea of the knowledge worker is to be made a reality then it requires that we recognise that intellectual capital is not the proprietary ownership of ideas but the creative mind unleashed'. Rather than 'closing the source code', open source cultural practices necessarily stress the collective nature of creative and intellectual production - something that the concept 'general intellect' alludes to. 'General intellect' has become immensely important in discussions around contemporary forms of collective protest - especially in the work of Negri and Lazzarato, and herein in the contribution by Nick Dyer-Witheford (pp. 71-93) - as an extension of what the autonomists call a 'social factory'. The original source of the term is a section in the *Grundrisse* (1981) entitled 'Fragment on Machines', in which Marx describes that at a certain point in capitalist development, real wealth will be measured not on labour time in production but on technological expertise and organisation.[6] It prefigures networked communications technologies, human-machine subjectivities and their importance for the restructuring of capital. The critical argument, in Marx, is that the general intellect unleashes contradictions by combining scientific knowledge and social cooperation. Firstly, as less and less labour is needed, capitalism undermines its very social order that is based on class exploitation. Secondly, the increasingly social nature of labour undermines private ownership and systems of wage payment. Through the concept of general intellect, capital can be seen to be setting the conditions for its collapse. In this context Negri and Lazzarato conclude that capital appears

to have successfully contained this 'mass intellectuality' within its structures by the complex management and control of knowledge. Therefore new forms of protest derive from this limited access to and exclusion from what should be generally available. It is easy to see evidence of this, for instance in antagonisms over intellectual property in the network society.

Engineered creativity

New antagonisms can also be seen in new management techniques that appear to place value on creativity and enterprise in the 'knowledge-for-profit economy'.[7] This is evident in the context of higher education as one of many sites of market-driven economic expansion, tied to the development of high-technology industries. In 'Cognitive Capitalism and the Contested Campus', Nick Dyer-Witheford introduces the term 'cognitive capitalism' to describe the commercial appropriation of general intellect:

'Universities are now frankly conceived and funded by policy elites as research facilities and training grounds for the creation of the new intellectual properties and technocultural subjectivities necessary to post-Fordist accumulation regime'.

In this manner, etoy's satiric 'day-care activities' project (pp. 31-37) involves education and genetics specialists setting out to 'configure the future of digital art' by converting children into data-packages, 'providing them with an entry point into art production, identity design and electronic authorship' to engineer a 'subversive identity-extension'. Such a blatant example of bio-tech engineering a designer subjectivity stands in contrast to former levels of academic autonomy and the university's role as a site of contestation and liberal (sometimes even radical) thinking.

In the University, the reorganisation of labour creates new relations between dissenting academics and oppositional social groups. Dyer-Witheford is here drawing upon Lazzarato and Negri in arguing that the closer relation of universities to capitalism produces a more effective opposition from within to

the ways in which 'general intellect' has been appropriated. Rather than act from some lofty position, academics are forced into a position of solidarity with other workers. Similarly, an increasing student population has become part of 'immaterial labour' and subject to forms of exploitation - rekindling Marcuse's statement that students are the new proletariat. Students are often caught in living/working contradictions: 'as subjects of disciplined preparation for privileged managerial responsibility, [and simultaneously] as subservient and badly-paid service workers'. These conditions shift contestation from the factories to the campus, argues Dyer-Witheford. The challenge for intellectuals, and those working in Universities, is to engage in the public sphere without simply falling into the research and enterprise culture of capitalist renewal. Necessarily as universities concentrate their energies on engineering and technology disciplines, forms of dissent to capitalism correspondingly employ the same tools in response to its control over the means of production. In this way, The Institute for Applied Autonomy (IAA), in 'Engaging Ambivalence', describe their use of the 'visual and rhetorical devices of sanctioned research organisations to infiltrate engineering culture', initiating projects that are presented as 'research findings'. In particular, IAA explores 'expressive opportunities afforded by appropriating the tools, techniques, and terminologies of the military-industrial complex'. They concentrate on the 'engineering research' of the US Department of Defence and its Defence Advanced Research Projects Agency (DARPA), exposing the transfer of funds from military to academic and corporate research labs in exchange for technological innovations for military purposes. This reveals the tensions between military and academic approaches to knowledge production under the disguise of 'cultural co-production':

'The ambivalence embodied in these contradictory formulations of engineering practice is enabled by a conception of technology as value-neutral tool that, by extension insists technological development is an ethically indifferent activity. This instrumental view of technology and ambivalence towards the world are normalised through immersion in engineering culture - primary in technical universities'.

In the UK, the military sector also plays a disproportionate role in setting the research agenda for science and engineering - according to a recent report 'Soldiers in the Laboratory' published by Scientists for Global Responsibility (Radford 2005). Like the US, this is a trend on the increase, with plans in the UK to boost spending on high-technology military capacity over the next five years currently standing at 30% of the overall public research and development budget and with the Ministry of Defence employing 40% of all government researchers.[8] The special relationship between the UK and US runs deep and reveals: 'a new military-industrial complex of the 21st century - military-led funding of exotic technologies and hi-tech weaponry rather than technology to address pressing social needs' (Radford 2005; quoting Philip Webber, Chairman of Scientists for Global Responsibility). At the heart of this, is the link between weapons development and arms sales, informing the agendas of innovation - from space orbital technologies during the cold war to new missile technologies and the recent interest in nanotechnology and 'smart' materials. One might speculate on future threats dreamt up by appropriately named 'think tanks'.

These tendencies are further emphasised in the merger of academic and corporate interests encapsulated by the growth of research parks, private sector consultancies and the emphasis on enterprise or what is now called 'innovation' (at least in the University where we work). Dyer-Witheford also points to the changes in intellectual property laws that enable Universities to exert ownership over patents, granting them commercial incentives for particular kinds of research activity. In this respect, visibility and accountability are directly addressed in the Bureau of Inverse Technology (BIT)'s project *bit plane* (pp. 63-68), a radio controlled model airplane equipped with a micro-video camera and transmitter launched over no-camera zones of the corporate research parks in Silicon Valley - the largest concentration of venture capital in the world. Corporations under *bit plane*'s flight path included Apple, IBM, Lockheed, Dolby, Intel, Netscape, Sega, Oracle, Yahoo, SGI, Adobe, Atari, Compaq, Sun, 3Com. Here, issues around intellectual property, information as property and information control are seen to be crucial:

'The traditional view of photography, evidence and information reinforces a definition of information as property - and therefore that property laws can hold. The Bureau holds that information doesn't in fact exist or circulate in those sorts of forms.'

Digital Producer

For Benjamin, the progressive writer or cultural producer acknowledges the choice of in whose service, or more particularly class interests, the writing (artwork) operates. As a result, he argues that for a work to be 'politically correct', it must simultaneously be correct in the literary or artistic sense. The first principle he establishes is that the work is not autonomous in itself and according to materialist criticism must be inserted into the context of 'living social relations', themselves determined by production relations. Instead of making the usual opposition of whether a work is reactionary or revolutionary, he simply asks: what is its position *within* the production relations of its time - and this for him is a question of 'technique', combining skill and technology. He cites the Russian writer Tretyakov who as an 'operative' writer typifies suitable technique and lies outside the established canon of literary forms as a journalist. The argument follows that the category of literature should evolve according to the energy of the time and include new forms and confusions - employing the new technology of the time.

More recently in *Writing Machines*, N. Katherine Hayles stresses the importance of materiality in describing the many agents of production: 'The engineers who design these machines, the factory workers who build them, the software designers who write programs for them, and the technicians who install and maintain them...' (2002: 6). She adds the materiality of the text itself to the analysis, in a similar way to those in the software critical community who consider code to be material (in addition to hardware). In this way, it is the materiality of writing itself that is expressed through the relationship between natural language and code - one tended towards free form and expression, the other towards control and precision. It is the interplay between the two modes

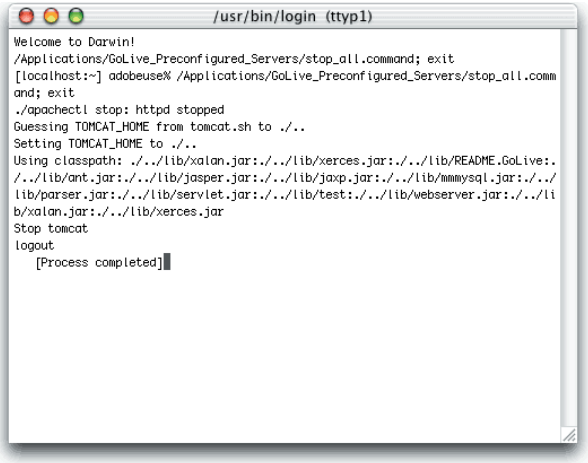
that is of concern for Hayles's materialist position. What she calls a 'technotext' brings into view the technical apparatus or writing machine that produces it. The materiality therefore requires attention to the technical apparatus, but also to the program - the activity of programming and the activity of the program once executed.

The materiality of text or code is further verified by the property rights exerted on it. Examining the Free Software Movement and Net Art, Josephine Berry Slater in 'Bare Code' (pp. 133-149), sees the practice of hiding the source code as narrowing its creative potential, and enforcing a series of mythologies around creativity and property rights. Conversely, there are more radical examples than mere arts practice as such. She cites the award of a prize to the GNU/Linux operating system at the *Ars Electronica* festival in 1999, and sees this as not only the 'Duchampian gesture of nominating a tool of production as a work of art', but also a classic example of the analogy between avant-garde art and free software in challenging myths concerning creative production. These issues relate to the collective nature of free software production but also to the breakdown of firm distinctions between producers and consumers. The individual artist, even software artist, might be 'compared to the capitalist who harnesses and thus alienates proletarian labour power into surplus value'. For Berry Slater, the overt reference to Benjamin's 'The Author as Producer' essay confirms an engagement with code as material and the relations of production that are expressed in the shared production of free software in the context of the informational economy. This allows her to question that if: 'net artists use proprietary software to produce their work, to what extent can they be said to be transforming the apparatus of production?' Not very much of course. Accordingly, she concludes:
'A radical realisation of art, then, would be the deposition of the sovereign producer and a return of the shared wealth of creativity to its true owners: the multitude. For this reason, a reappropriation and transformation of the artistic means of production comes to the fore - an opening up of cultural source codes to an undetermined end.'

The opening up of source code and the apparatus in general allows new forms of practice to emerge. Benjamin's example of this regenerative process is the newspaper, as it throws into question a number of established separations - of academic and popular modes, of descriptive and creative writing, but perhaps most particularly the separation between writer and reader:

'For as literature gains in breadth what it loses in depth, so the distinction between author and public, which the bourgeois press maintains by artificial means, is beginning to disappear in the Soviet press. The reader is always prepared to become a writer, in the sense of being one who describes or prescribes. As an expert - not in any particular trade, perhaps, but anyway an expert on the subject of the job he happens to be in - [s]he gains access to authorship. Work itself puts in a word. And writing about work makes up part of the skill necessary to perform it. Authority to write is no longer founded in a specialist training but in a polytechnical one, and so becomes common property.' (1983: 90).

Elsewhere drawing upon the work of Roland Barthes, Florian Cramer makes the distinction between 'readerly' and 'writerly' texts and applies this to operating systems (2003). Rather than the readerly properties of a GUI (Graphical User Interface) operating system that encourages consumption, the command-line operating system of Unix is seen as writerly, in terms of its openness and in



encouraging the reader to become a producer of text (such as is possible if one was to take a free workshop at the Faculty of Unix). This is important for Cramer, as it breaks down the false distinction between the writing and the tool with which the writing is produced, and in terms of the computer, between code and data. It is almost as if GUI software disguises itself as hardware (2003: 101), using crude and patronising analogies like desktops with the classical Macintosh interface. On the other hand, the Unix command line holds multiple possibilities for transformation and manipulation - combining instruction code and conventional written language - into 'operative' forms.

The functional relationship between text (and this can be extended to include code in the current context) and production is exemplified for Benjamin through the opposition of 'the dramatic laboratory to the finished work of art' (1983: 100). The model of cultural production proposed is to regard the product as a process equipped with an instructive or educational function and providing an improved apparatus. In 'The Process is the Product' (pp. 127-131), Redundant Technology Initiative takes an ecological approach and proposes to transgress existing mechanisms of the over-production of technology, changing consumption patterns from the use of open source software to recycling old hardware, and then training people to use it. Such practices emphasise the collaborative nature of cultural production and collective work, undermining the orthodox relationship between producer and consumer. Indeed many of the contributions to this volume use 'Wikis': a collaborative authoring system for hyperlinked documents on the web.[9] 'George's Wiki' (pp. 106-109) is a filtered list of appropriated consumer technologies. User modifications reveal some of the cultural contradictions, in as much as they appear to undermine the intended consumer and producer distinction and at the same time emphasise the speed and sophistication of recuperation. The Wiki, both in terms of form and content is offered for continual update and will eventually inform a series of proposed workshops. As Benjamin notes, cultural production requires a pedagogic function. It must have the function of a model, turning consumers and readers alike into collaborators:

'The crucial point, therefore, is that a writer's production must have the character of a model: it must be able to instruct other writers in their production and, secondly it must be able to place an improved apparatus at their disposal. This apparatus will be the better, the more consumers it brings in contact with the production process - in short, the more readers or spectators it turns into collaborators.' (1983: 98)

The 'prosumer' characterises this breakdown of the distinction between producer and consumer, that has become an orthodoxy of the global communications apparatus. This is what Pit Schultz characterises as 'The Producer as Power User' (pp. 111-125) - both 'consuming power and being consumed by it'. In this way, a power user is distinguished from an average user by the depth of knowledge of the technical apparatus, such as using Unix or calculating machines at a level of complexity: 'Driven by the will to knowledge, the power user will ultimately empower herself by giving knowledge away. The more intellectual property is collectified, the more sources are open, the more of a critical mass of free knowledge becomes possible'.

Rather than the linguistic aspects of software production, Matthew Fuller in 'Freaks of Number' (pp. 161-175) is keen to historicise this in terms of calculation, and sees Maurice d'Ocagne's 'Le Calcul Simplifié par les Procédés Mecaniques et Graphiques' (1893) as an early example of computer criticism. To Fuller, the standardisation of objects typical of industrial production follows this same numerical logic. In conventional culture, it is almost as if programmers exhibit a numerical disorder in following this logic. Software art in this sense is a mechanism for a reverse tendency, a critical means for the exploration of how software propagates the standard object. He says:
'On the scale of numbers, post-industrial society is perhaps something that occurs when the 'avalanche of numbers' of Hacking, an enormous and self-generating torrent of factualisation, tabulation and recording meshes with numericalised labour, mechanisation and product and informational standardisation and variation.'

To Fuller, mainstream computing is locked into a 'neo-Platonism' that finds aesthetic value in the most simple, pure form of a solution to a given problem. By way of contrast is the playfulness of Harwood's *London.pl* (reproduced in this publication, pp. 151-158) based on, or rather plagiarising, William Blake's poem *London* written in the last decade of the eighteenth century. Here, in both works, statistics and the modulation of populations are used for social comment. In the Harwood version, arguably, the contemporary 'arithmetico-material' conditions are doubly registered both in content and form. For instance, one line of the program comments reads: '# Find and calculate the gross lung-capacity of the children screaming from 1792 to the present'.

An activity like hacking perhaps offers some hope and, at least in potential, allows for the synthesis of commitment and quality that Benjamin proposes. McKenzie Wark would argue that information is kept in chains, and continues to focus attention on the central importance of property relations and the activity of hacking as 'the production of production' (in *A Hacker's Manifesto*, 2004). To the programmer Jaromil, this sentiment is expressed in what he calls Babylon's insistence on proprietary models of ownership as a form of slavery, racism and oppression (pp. 203-206). He positions his 'Rasta Software' in opposition to this, taking inspiration from Rasta culture as analogous to GNU free software principles. Extending this argument in 'Roots Culture - Free Software Vibrations Inna Babylon' (pp. 177-201), Armin Medosch draws an analogy between Rasta's critique of the power structures, the class system and knowledge system (of Babylon) and the ways in which Free, Libre, Open-Source Software (FLOSS) was adopted by programmers as a critique of the corporate world. Unlike Rasta culture, however, he argues that rather than rooting alternative practices in communities, FLOSS can be seen to be detached from its 'roots' unless it is placed within a culture (citing positive examples that infuse culture into software - such as Jaromil and Harwood). This is where the distinction between open source and free software is important as a critique of power structures. Medosch explains that the distinction was made by Richard Stallman not on a technical level but on an ideological one in that:

'free software is linked with a political concept of freedom centred around freedom of speech; whereas open source is linked with pro-business computer libertarians and the idea of releasing source code and developing software collaboratively appealed to business like IBM or Sun as a potential antidote to the market dominance of Microsoft'. In this sense, open source is the embodiment of pure engineering, in contrast to free software as technical and cultural engineering. This publication aims to emphasise this distinction.

Resistance to market forces, argue Raqs Media Collective in 'X Notes on Practice' (pp. 209-227), lies in the domain of the 'artisan'[10] who: 'mediates the transfiguration of people into skills, of lives into working lives, into variable capital'. Increasingly, and under the conditions of an economy based on intellectual property and immaterial labour, the distinction between worker and artist breaks down, and the value they produce becomes standardised. The 'worker as artist', or 'author as producer', now labours in a scenario where information and communication dominate the process of production. In this sense all workers operate like artists in producing meanings and knowledge. For instance, Raqs suggest the call centre worker of globalised corporate capitalism displays 'imaginative skill, and a combination of knowledge, articulateness, technological dexterity and performativity'. The radical artist is thus required to engage with the production of knowledge and intellectual property - what Raqs call:
'the protocols of networked conversation [...] across sites, across different histories of locatedness in the network; to invent protocols of resource building and sharing, create structures within structures and networks within networks'.

The issue for Raqs is how workers (or artists) can recuperate a sense of agency and human dignity in the face of migrant labour, exploitative practices in free trade zones and contemporary forms of slavery as symptoms of the logic of capitalism. How might we imagine and implement new economic models based on self-regulation and free exchange 'outside the circuit desired by capital' (such as the example of factory workers in Buenos Aires). They ask: 'how might we

begin to consider and understand the global figures of the alien, the encroacher, the pirate, the hacker and the worker defending their machine?' In this scenario, the author as digital producer is empowered by their ability to engineer an alternative culture.

This is what Benjamin proposes as an engagement with the technical apparatus at a deep level of understanding. Can we begin to see that conventional interfaces and operating systems cut the majority of users off from a deep understanding of what is actually taking place, and stops them from becoming active cultural producers? Might this be the purpose of cultural practice, to reveal these tendencies - to actively engage with the technical apparatus to elicit social change and challenge proprietary models? To engineer change and to believe in the possibility of social transformation, it remains necessary to transform the cultural producer 'from a supplier of the production apparatus, into an engineer who sees his task in adapting that apparatus' (1983: 102).

NOTES:

This publication has been partly informed by the 'Artist as Engineer' symposium (University of Plymouth 2003) as part of 'Interrupt: artists in socially-engaged practice', a series of five symposia initiated by the Visual Arts department at Arts Council England.
Vivienne Reiss, 'Interrupt' co-director, Senior Visual Arts Officer, Arts Council England, writes: 'Socially engaged, collaborative and situated art practices have a substantial history often formed by artists stepping outside the various institutional frameworks of commissioning, exhibiting and critiquing contemporary visual art. These artists often work with initiatives which have specific educational and social agendas and outcomes. 'Interrupt' was a collaboration with a number of galleries and higher education institutions. The aim was to stimulate discussion around the central question: Where does socially-engaged, participatory and education arts activity stand within current debates around contemporary arts practice? Interrupt brought together artists, educators, curators, producers, cultural theorists and commentators to explore the diversity of approaches, and to describe and contest this field of practice.'
For more information visit the 'Interrupt' web site <http://www.interrupt-symposia.org>.

1. 'The Author as Producer' was first written as a lecture for the Institute for the Study of Fascism, in Paris, April 1934. Over the years, the essay has been extensively reworked as the opposition of theory versus activism - reproduced in full as the first chapter of Victor Burgin's Thinking Photography (first published in 1982), and more recently reinscribed by Hal Foster as 'The Artist as Ethnographer' in The Return of the Real (1996).

2. Of particular interest is Klüver's collaboration with Robert Rauschenberg, 9 Evenings: Theatre and Engineering, which incorporated new technology developed by 10 artists working with more than 30 Bell Labs engineers.

3. Hardt and Negri more recently remain convinced that the realm of production is still where 'social inequalities are clearly revealed and, moreover, where the most effective resistances and alternatives' arise (2000: xvii). The subject of labour as agents of change, fall under new conditions of production, that continues to separate the producer from the means of production and thus creates class conflict.

4. Class conflict has gone global, in other words. It should also be said that this describes a general tendency, but the forms vary according to local specificities. In this publication, Raqs Media Collective explore some of these issues in the context of India as a rising economy based, upon knowledge accumulation and access to technology.

5. The University of Openness is a framework in which individuals and organisations can pursue their shared interest in emerging forms of cultural production and start a faculty to socialise their research <http://twenteenthcentury.com/uo/index.php>.
The Faculty of Unix offers free weekly Unix classes since 2002 <http://darq.org.uk/FacultyUnix>.

6. The crucial element will be the 'general powers of the human head', 'general social knowledge', 'social intellect' owing to the increasing power of the importance of machinery (Dyer-Witheford 1999: 220; quoting Marx directly). The productive forces of the intellect, of human knowledge and skills are incorporated into capital itself. At the time, Marx was thinking of the increasing importance of automatic systems for production and the networks of its communication, the world market.

7. Lazzarato even thinks these new techniques are more totalitarian than the production line, as it deludes the worker into thinking they are an active participant in the process (1999: 224). As with interactive art, participation, whether through teamwork in the workplace or over global communications networks is thoroughly contradictory, according to Lazzarato. As a result, conflict arises between capital's objective control and the relatively autonomous subjective nature of the work. The intellectual and creative activity of hacking is a prime example of the contradiction at

the heart of capital's attempt at control, as it is both a necessary skill and criminalised when it is out of control.

8. The UK is the third largest military spender, and the second largest spender on military science, engineering and technology. It is easy to guess which country is the first largest spender on 'weapons of mass destruction'.

9. George's wiki herein uses PmWiki, a WikiWikiWeb system developed by Patrick Michaud in the PHP scripting language. The software is freely available under the GNU Public License and may be downloaded from <http://www.pmichaud.com/pub/pmwiki>.

10. Richard Barbrook and Pit Schultz in their 'Digital Artisans Manifesto' (1997), reject the idea that the Internet is the final stage of alienating effects of machines, and instead emphasise the centrality of autonomous and creative labour in this process as the force of historical change: 'We will transform the machines of domination into the technologies of liberation'. It is argued that this transformation can come about by rejecting neo-liberal work patterns of the free market, the 'californian ideology' and formation of a 'virtual class'. Instead they propose the digital artisan, in which autonomous work is made possible in the manner of past craft workers 'able to assert their autonomy precisely within the most technologically advanced industries' (1997).

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