How Does Technological Development And Adoption Occur In The Media? A Cultural Determinist Model

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Critical commentary on published works submitted in partial fulfilment of the requirements of the University of Lincoln for the degree of Doctor of Philosophy on the basis of published work.

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Contents

Abstract

The thesis hereby submitted, 'How Does Technological Development And Adoption Occur In The Media? A Cultural Determinist Model' was originally published in *Media Technology and Society A History: from the telegraph to the Internet* (London: Routledge 1998) and *Technologies of Seeing: Photography, Cinematography and Television* (London: British Film Institute 1996). The argument outlined in those two books is further supported and updated by six other texts published between 1995 and 2005 on the same topic.

Media Technology and Society A History: from the telegraph to the Internet deals with the development of electrical and electronic mass media proposing a model for the nature of such developments. It is a final iteration of an approach to this history which has its origins in work first begun in the 1970s. *Technologies of Seeing: Photography, Cinematography and Television* applies the same model to photographic and cinematographic technologies. The thesis argues that all these media developments can only be understood in a social context; that they are to be understood as examples of what has become known as 'socially shaped technology'[1] (or, in terms of the thesis, 'cultural determinism').

This is contrary to the received dominant view that technology itself is the driver determining social formation – termed the 'technological determinist', 'technicist' or 'diffusion theory' approach. In rejecting technicism, 'How Does Technological Development And Adoption Occur In The Media? A Cultural Determinist Model' proposes instead an original, pioneering contribution to a revisionist cultural determinist/SST historiography as well as outlining a model to explicate at a theoretical level how such innovations and adoptions occur.

[1] See: Mackay & Gillespie,1992

The Portfolio of Published Work

The Thesis:

1998 ***Media Technology and Society: A History from the telegraph to the Internet*, **London: Routledge (0--415--14229-6).

Reprinted1999x2, 2000,'03,'04

*(RECIPIENT, **BEST BOOK OF 1998**: AMERICAN ASSOCIATION FOR HISTORY AND COMPUTING.)*

(2001 Innovation, Chapter 1 translated as "Ein Sturm von Paradies: Technologische Verbreitung und unterdrüking/ Die Informationsrevolution als Hyperbel" in Lorenz Engell & Joseph Vogel, eds., *Mediale Historiographien* Weimar: Universitätsverlag Weimar (3 86068 158 3).

(2000 Chapter from *Misunderstanding Media* (1986) London: RKP [first version of *Media, Technology & Society*] reprinted as "Breakages Limited" in John Caldwell, ed., *Electronic Media and Technoculture*, New Brunswick, New Jersey (0-8135-2734-1).

1996 (a) ***Technologies of Seeing: Photography, Cinematography and Television*, **London: British Film Institute (0-85170-001-0).

(2000 Chapter reprinted as "Necessities and Constraints: A pattern of technological change" in Robert Stam & Toby Miller, eds., *Film and Theory: An anthology*, Malden, Massachusetts: Blackwells (0-631-20625-6).

(2003 Chapter 1 reprinted as "Technologies of Seeing" in Jeffrey Shaw & Peter Weibel, eds., *The Cinematic Imaginary after Film* Cambridge, Mass.:the MIT Press (0-262-69286-4).

Supporting Texts

*1995 "How are media born and developed?' in John Downing, Ali Mohammadi & Annabelle Sreberny-Mohammadi, eds. *Questioning the Media* Thousand Oaks, CA: Sage (0-8039-7197-4) {2nd Edition, first published 1990}

*1996 (b) "Myth of the Internet", (with Paul Walton), *Index On Censorship*, Volume 25, No. 1, Issue No. 168, January.

(1996 Reprinted, *Vertigo*, Autumn, Issue 6)

*2001 (a) "Smell the Tulips: the internet, neoliberalism and millenarian hype" in Stephen Lax, ed., *Access Denied*, London: Macmillan (0-333-92019-8).

*2001 (b) "The Coming of 16mm sound film" in Jochim Polzer, ed., *Weltwunder der Kinematographie*, Potsdam: Polzer Media Group (3-934535-20-8).

*2002 "Media Technology" in Michael Schudson, section ed., *International Dictionary of Social & Behavioural Sciences*, Amsterdam: Pergamon.

*2004 "Technical History of Television" in Michelle Hilmes, ed., *The Television Book*, London: British Film Institute (0-85170-988-7).

Introduction

This candidacy for a doctorate on the basis of published work rests on the portfolio of eight published items listed above, and on this accompanying critical commentary.

This commentary, in accordance the University of Lincoln's Research Degree Regulations, has be designed to furnish an explication of the initial thesis being proposed , its intellectual context and an account of its development; as well as an account of the further materials up-dating it, and some assessment of its reception. The commentary therefore demonstrates how the portfolio constitutes a significant, coherent pioneering contribution to the field of media studies, specifically:

a) to an emerging revisionist tradition of media history, viz.: the history of the development of media technologies since telegraphy by grounding such developments in the social sphere ('SST'/'cultural determinist'); and
b) to a parallel emerging critique of the dominant view of this history as being 'technologically determined' and therefore inadequate; and
c) to an original and coherent model of how such culturally determined technological development (SST) has operated to diffuse new media technologies throughout the period since the Industrial Revolution.

The commentary is organised:

a) to provide a synoptic account of the thesis;
b) to afford an intellectual context for its development:
    i) first in terms of a critique of the received history (i.e. technicism)
    ii) then in terms of my own intellectual formation and the specific development of the thesis as a revisionist historical project termed cultural determinism;
c) to contextualise the supporting texts as further applications of the model outlined in the thesis to developments not dealt with in *Media Technology and Society A History: from the telegraph to the Internet* or *Technologies of Seeing: Photography, Cinematography and Television*;
d) to discuss the methodology deployed;
e) to assess the reception of the thesis;
f) to offer issues for further work.

It is assumed that the portfolio, in the order presented, will be read prior to this commentary.

Declaration and Acknowledgements

All parts of this thesis are my own work, with the sole exception of "Myth of the Internet", an article jointly authored with Paul Walton in 1996.

Critical to this dissertation is the encouragement of Professor Sylvia Harvey without whom the work would not have been undertaken.

Ideas contributing to the development of the thesis date back more than three decades and to make a full acknowledgement of my debts to all who have influenced and informed the work is therefore not entirely possible. But I can note that my earliest published thinking on this topic (1974) acknowledges Nicholas Garmham, Dave Ryden and the late Caroline Heller. The first book-length articulation of the model (1986) was deeply indebted to my then colleagues at New York University, especially William Boddy and Michelle Hilmes. The colleagues influencing and informing the two major texts here submitted are duly acknowledged in the attached electronic copies of the books.

For guidance in writing this commentary I am most grateful to Professor Sylvia Harvey and Dr. Ann Gray, my supervisors.

And it is to them, my other Lincoln colleagues and my family that I dedicate it.

Critical Commentary

The Central Thesis

How does technological development and adoption occur in the mass media?

Any chronological list of important milestones in communications media is likely to give significant place to technological developments. For example, Downing, Mohammadi & Sreberny Mohammadi determine that between Cro-Magnon's possible acquisition of language circa 35,000BC and the development of a 'silicon superchip' in AD1994, no less than a third of significant date commemorate 'technological breakthroughs' (1995: ix-xii). The most widely understood narrative explicating this sequence offers, in essence, a series of overlapping biographies of 'inventors' – Gutenburg and Daguerre, Morse and Bell, the Lumiérès and Marconi, Baird and Turing etc. etc. – until, by the mid-20th century, the work of 'invention' is wholly subsumed by the research and development laboratories of great corporations whence emerge, as the products of usually anonymous technicians, the transistor and the pocket calculator, the digital watch and the videotape recorder, the mobile phone and the TV satellite etc. etc. – in an unending stream, usually perceived as ever more life-enhancing (or, more rarely, culture-threatening).

This thesis is a response to the inadequacies of such popular accounts of these milestones. Neither the history of the development nor the impact of technological developments in the media can be effectively captured by a narrative which is merely the 'progress of great men' – aside, of course, from the fact that women and non-Europeans figure little, if at all, in it. Such accounts grossly simplify the complexities of technological creativity; pay scant regard to social contexts and realities; and are frequently distorted by national biases and basic error. [2]

[2] Johannes Gutenberg (c. 1400 – 1468) is conventionally credited with the first printed press from moveable type in the West; but he was not the only person at work on this technology at the time and moveable type was anyway long established in, at a minimum, Korea and China. Charles Daguerre (1787 -- 1851) is conventionally credited with the development of photography but he was a showman working to an agenda determined by his partner Nicéphore Nièpce (1765 -- 1833) and anyway his system produced unique images unlike the photographic process that was to prevail which used negatives capable of producing multiple copies. Samuel Morse (1791--1872) was a portrait painter who relied on other scientists and technologically more sophisticated minds, for example, Joseph Henry, a physics professor at the institution that was to become Princeton. He too had many legitimate rival claimants to the title 'inventor of the telegraph'. Alexander Bell (1847 -- 1922) was an elocution teacher with an interest in deafness. He, like Morse, relied on assistants, notably Thomas Watson (1854 -- 1934), an able young electrical engineer. It is also probable that Bell's first effective telephone was the result of his being given a sight (illegally) of the patent application of his rival Elisha Gray (1835 – 1901). The Lumière brothers (August 1862 -- 1954 and Louis 1864 to 1948) were not, as is commonly supposed, responsible for the first cinema show for a paying audience in December 1895. Theirs was the fourth and they were among a host of entrepreneurs and technologists working on movie image systems at that time. Guglielmo Marconi (1874 --1937) was more of

It is possible, however, to see 'the great men' account of technological change as a vulgar variant of an equally pervasive but more refined approach, now termed 'diffusion theory' (see, for example, Rogers, 1995). Diffusion theory shares with the 'great man' approach an inherently linear sense of technological developments as a species of 'progress' as that concept is commonly understood; and whether for good or ill. It does, however, deal in a fuller and more complex fashion with the scientific and technical contexts in which developments take place but, in common with much history or sociology of science, tends to focus less on broader social factors. It privileges the 'progress' of technology as a determining factor on the broader society and can therefore be termed a 'technological determinist' or 'technicist' approach. The technicist tradition has a (dominant) positive 'technophile' bias that sees new technologies as beneficent; but there is also a significant 'technophobe' strand in the tradition, equally insistent on the socially-determining nature of technology but seeing this as, in some instances, baleful. The point is that both the technophile and the technophobe variants of technological determinism put technology before (as it were) society. The thesis herein proposed is therefore as much as response to the inadequacies of developed technicist accounts as it is to the vulgarities of populist 'great man' narratives.

It does not stand alone, however as both in the broad history of technology and in the more specific area of media technological history there has been a second more recent and less popularly understood approach which, in essence, denies technology as the driver of social change. Instead, society is conceived of as the major factor determining the technological agenda and conditioning the diffusion of the technologies it produces. This 'social shaping of technology' – 'SST' -- is also deterministic and can therefore be termed 'cultural determinism'; but it seeks to place the work of the technologist within the broader social sphere suggesting that the technological agenda is influenced by social needs and that the successful diffusion of any given technology depends on its social acceptability, its 'fit' (as it were). As it denies technology a

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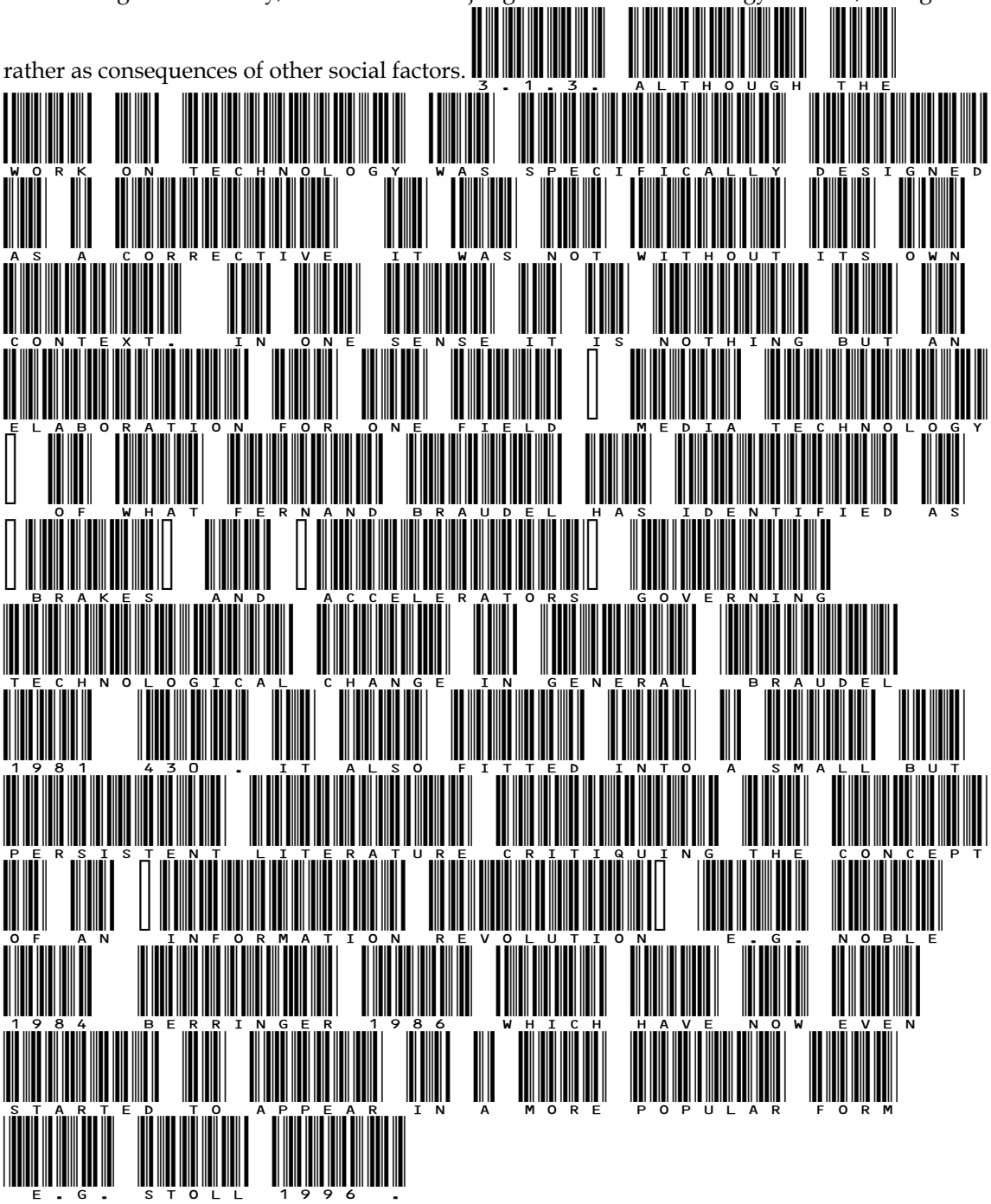
a scientist than these others being a physics graduate from the University of Bologna – which is why he knew about the devices he used for his radio experiments. His contribution – no small thing – was to realise that the higher the aerial the further the signal could be sent. Needless to say, others were at work on wireless telegraphy at the same time. (He was also the only one among this group to receive a Noble prize -- for physics in 1909.) John Logie Baird (1888 – 1946) was a failed entrepreneur who became obsessed with mechanically scanned television and never fully grasped the principles of electronic scanning which were to prevail. Nevertheless, the British popularly persist in regarding him as 'the father of television'. Alan Turing (1912 -- 1954) was, undoubtedly, one of the most influential mathematicians of the 20th century, responsible, in 1936, for a breakthrough paper which lies at the very foundation of computing science; but he was not, as is increasingly being popularly claimed, a father of computing in any practical sense. In fact, he had trouble changing light bulbs. The popular understanding of the nature of technological change in the media is completely inadequate.

determining role in society, it tends to be less judgemental as to technology's effects, seeing them rather as consequences of other social factors. 

Given the wide reception of technological determinist explanations of technological change, cultural determinism can often seem counter-intuitive, rejecting technology as an engine of social change and resisting arguments that it is either 'out of (social) control' or that it materially alters social – much less (as is sometimes claimed) human sensory – realities.

This thesis is a pioneering contribution to the cultural determinist (SST) approach as it can be applied to media technology. In essence it attempts to correct technicist failings by seeking to be more firmly grounded in social science and history and thereby better rising to the basic challenge of capturing of the myriad complexities of social phenomena with which it deals. It does this by attempting to write what anthropologist Cliford Geertz has termed 'thick' (i.e. nuanced, multifaceted, comprehensive) accounts (Geertz 1973). Given that the assumption of cultural determinism is that society shapes technology there is, as a consequence, an inevitable element in the analysis which takes cognisance of the past -- i.e.: what is the background to the social factors that have been at work conditioning the technological agenda? The thesis uses a detailed history of the media to develop a theoretical pattern explicating how innovations are born and brought to the point of effective diffusion. Its novelty lies in the application of a theoretical pattern drawn from structuralism being applied to the narrative history.

In contradiction to the basic tenet of technicism – that technologies advances inexorably – the historical record reveals that its diffusion is far from inevitable that they do so. Indeed, the opposite is true. Fernand Braudel[3] puts it in this way:

> First the accelerator, then the brake: the history of technology seems to consist of both processes, sometimes in quick succession: it propels human life onward, gradually reaches new forms of equilibrium on higher levels than in the past, only to remain there for a long time, since technology often stagnates, or advances only imperceptibly between one 'revolution' or innovation and another (1981:430).

It is therefore the case in Braudel's view that, although science and technology, as are 'uniting today to dominate the world -- such unity *depends necessarily* upon the role played by present-day societies, which may encourage or restrain progress, today as in the past'. What drove the changes we call the industrial revolution, changes which made the modern world, were grounded in the societal forces unleashed by early Western capitalism and the imperial expansion of Western nationalism. In other words, society always leads technology.

Media technologies, at least as far as the historical record is concerned, exhibit the characteristics of other technologies and are just as subject to Braudel's accelerators and brakes. A case cannot be made for any sort of media technological exceptionalism, although the most hyperbolic technicist rhetoric often does this. This, though, is without prejudice to the possibility that other

[3] Fernand Braudel (1902 -- 1985) was a leading historian of the *annaliste* school. He has been called 'the greatest historian of the 20th century'.

technologies (unexamined here) can better make an exceptionalist case -- e.g. medical or military technology -- essentially because social 'accelerators' are more, and social 'brakes' are less effective in these areas. Therefore, although I am proposing that there is nothing particularly exceptional about media technology, nevertheless prudence suggests that any conclusions reached as to the pattern of its development and social diffusion should not be more broadly applied without specific further research.

Limiting this discussion to media technologies suggests that the complex Braudelian pattern of brakes and accelerators can be explained by a model which attempts to balance the lineality of historical development against non-linear social factors.

Modelling Technological Change in the Media

The two main sources conditioning the model in *Media Technology* and *Technologies of Seeing* were the historical record of media technologies from photography and the telegraph to the internet and structuralist linguistics. {The thesis is fully outline in the submitted books but a synoptic account of the model is attached as appendix A}

The historical narrative was interpreted according to Hemplerian assumptions as to the nature of historical causality. Hemple articulated a theoretical approach to causaulity in XXX (1942), QUOTE HIM FROM MISUNDERSTANDING ME. There is clearly a problem here since opposed to this view is…….Geyl But it seem to me viable to assume a general theory of the nature of historical change could be applied to the particular history of media technologies.

The second theory utilised in building the model was structuralism. Out of suasrrian linguistics this has emerged as a supertheory. For the model it seemed that the concept of transformation – from langue to parole, from deep structure to surface, could be melded effectively to dconstruct the process leading from the idea to the difussed device.

This became a structuralist explanation for change (utilising Chomskyan terms) whereby, against a ground of formal and informal scientific understanding (linguistic 'competence' in Chomskyan terms i.e. *langue*), technologists suggested transformative ideas (a stage I named 'ideation') which resulted in the creation, 'in the metal' of devices which were 'technological performances' (cf. Chomskyan linguistic 'performances' i.e. utterances or *paroles*) designated as 'prototypes' (Chomsky: 1979). Categories of prototypes were elaborated but the crucial point was that this process of competence, ideation and performance, and all subsequent phases of the model, took

place inside a social sphere which therefore determined the ideation transformation of scientific competences into technological performances.

A second transformative stage – which I designated 'supervening social necessity' — also arose from within the social sphere and impacted on this stream of technological performances with the result that, on a comparatively arbitrary basis, one of the prototypes – technological performances -- created subsequent to the operation of this transformative event was declared to be an 'invention'. Therefore, in communications, 'inventions' are prototypes created after the supervening social necessity (which could take a variety of forms as outlined in the model) was identified. Given that supervening social necessity created a general social context for the technologist's research and development activities, the phenomenon of simultaneity was thus not surprising; nor was the marginalisation of original thinkers and prototype builders.

What also needed to be explained was why hyperbolic claims for the impact of new communications technology did not ever actually materialise in significant 'revolutionary' outcomes (or, better, had not thus far done so). To do this required the introduction of another social transformative phase into the model, to operate subsequent to the 'invention' phase. I designated this a 'law', using quote marks to indicate that although its operation was certain enough to be always present, its specific outcomes were not quite as inevitable as the operation of a law's would (or ought) to be. This transformative 'law' argued that new media technologies, already determined by social necessities, were introduced – that is diffused – only in so far as their socially disruptive ('revolutionary') potential was suppressed. The price of diffusion, as it were, was exactly the suppression of those effects identified as inevitable revolutionary outcomes by hyperbolic technicists. The 'law' of the suppression of radical potential ensured the new technology's social 'fit' and conditioned the last phases addressed in the model, that of diffusion and spin-off.

Ergo the entire received rhetoric of an 'information revolution' was in error, supported by neither the historical record nor current situations. Technicist hyperbole was the result of significant historical amnesia and that many commonly received views – that technological change in media produced revolutionary social change; that the pace of technological development was increasing; that technology was somehow 'outside' social control – were spurious.

The Intellectual Context as a critique of received history (i.e. technicism)

Raymond Williams[4] elegantly suggests that:

> The basic assumption of technological determinism is that a new technology -- a printing press or a communications satellite – 'emerges' from technical study and experiment. It then changes the society or the sector into which it has 'emerged. 'We' adapt to it, because it is the new modern way (Williams 1989:120).

Therefore, technological determinism:

> is an immensely powerful and now largely orthodox view of the nature of social change. New technologies are discovered, by an essentially internal process of research and development, which then sets the conditions of social change and progress. Progress, in particular, is the history of these inventions, which 'created the modern world'. The effects of the technologies whether direct or indirect, foreseen or unforeseen, are as it were the rest of history (Williams 1974:13).

It can be argued that technological determinism has achieved its hold over the Western mind exactly because is meshes fundamentally with the Western mindset, notably the deep-seated concept of progress. By the 18th century Christianity's promise of human perfectibility had acquired a more materialist cast. The Enlightenment view was that the human race, now 'emancipated from its shackles released from the empire of fate' was 'advancing with a firm and sure step along the path of truth, virtue and happiness' (as Concordet put it).[5]

Crucial here is the image of humanity's 'advance'. This exactly echoes the technological determinist vision of a flow of emerging technologies determining the structures of the society. This reflection is not, it must be noted, dependent on sharing Concordet's optimism about the end result of this advance; humanity could just as easily be rushing towards an abyss. In the same way, new technology might be positioned as an engine facilitating 'truth, virtue and happiness'; or it could bring exactly the reverse results.

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[4] Raymond Williams (1921 -- 1988) was a mid-20th literary critic of considerable influence on the development of cultural studies, one of the first seriously to study the cultural formations of television (1974). He is not here defining technological determinism from a sympathetic viewpoint.

[5] Concordet was a contributor to the *Encylopédie*, a key work of the 18th century European 'enlightenment' edited by Diderot and D'Alembert.

However, the central difficult with technicist explanations is that they do not entirely explain the phenomena with which they deal.

2.2.1 Historical Amnesia

Technicist accounts are not, as in the 'great man' approach, simply wrong; but they are still inadequate as effective explanations of the developments they seek to describe.

By focusing on the technology there is a tendency to simplify. The pre-history of devices is truncated or entirely omitted. So, for example, sound film is a development within the area of Western lens and theatrical cultures and is therefore determined by centuries of pertinent advances. This truncating of history has a profound effect since it supports a vision of technological upheaval and constant change. It lies at the heart of the idea that developments are 'revolutionary' when in fact they are far more evolutionary.

The tendency to hyperbole is a widespread characteristic of technicism. Take Marshall McLuhan, among the first to make the media an object of study in the post World-War II era (and also one of the few to achieve celebrity thereby becoming in the process a major 'guru' of the 1960s):[6]

> Physically the printed book, an extension of the visual faculty, intensified perspective and the fixed point of view …. Socially the typographic extension of man brought in nationalism, industrialism, mass markets, and universal literacy and education. In bringing the ancient and medieval worlds into fusion – or, as some would say, confusion – the printed book created a third world, the modern world which now encounters a new electrical technology or new extension of man. (McLuhan 1964:157)

Here, in what has become a quite typical manner, hyperbole meshes with ahistoricism to suggest that a 15th century technological advance (printing from moveable type) is responsible social phenomena (nationalism etc) which only manifest themselves centuries

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[6] Marshall McLuhan (1911 -- 1980), professor of English at the University of Toronto. A Catholic convert who saw the modern world in terms of decline, he allowed his basic negative position to be systematically misinterpreted. Thus his opinion of advertisements as being a central mark of contemporary Western civilisation was taken by the advertising industry as a very welcome legitimation of its activities. Advertisers were responsible for propelling McLuhan into the public eye. When there he remained more or less silent as to what he really thought about contemporary culture.

later. But even where historical causality it not stretched in this way, there is a desire to overstate claims about social impacts.

Currently, at its most extreme, such hyperbole suggests that the technologies are advancing at a pace that wipes out the established truths of, say, economics or the lessons of history and old approaches have no further validity. Such spurious technicist reasoning was the root of the 'dot.com' stock market fiasco of the late 1990s. The old rules did apply after all and the market crashed.

By this date, the network which was supposed to be driving this revolution was, as we have seen in 2.1.2, half a century in the making and the 'digital revolution' within the 'Information Revolution' was in its sixth decade of development, the first device to encode an electronic signal digitally having been built in 1938 (Winston 1998:133-4). In turn that device relied on mathematical calculations as to sampling rates which had been theoretically determined a decade earlier. The digital devices, including the computer, that were to suffuse the market in the last quarter of the 20th century relied on solid state electronics which were not 'invented' (as is commonly believed) at the Bell Labs in 1948 but go back to experiments with semi-conductors in 1879. Cats' whiskers radios were the first solid-state technology to be widely diffused from the 1920s on. (These radios, of course, were in the boyhoods – they were all men[7] -- of more than one of the technologists who built the first transistors and computers after World War II.) It is therefore all too often the case that technicist accounts, in so far as they are necessarily historical – else how can 'revolutionary' impact, for example, be established – tend to be history written by amnesiacs.

The Intellectual Context as a revisionist historical project

[7] With the singular exception of Grace Hooper (1906 – 1992), an American naval officer who, from a position of considerable influence in the US Office of Naval Research, was responsible in the early 1950s for encouraging (against considerable hostility) the development of computer languages. She retired as an admiral.

1.2.

My interests have developed since I first published in the discipline 30 years ago but my central concerns have remained constant. The following briefly sketches this background:

1.2.1. I am not a trained scholar as I left university, having read law, in 1963 to become a television researcher and, over the next decade, a director and producer. I was moved to begin a study of the industry in which I worked because of a growing personal dissatisfaction with what I felt were the day-to-day limitations of public service broadcasting: that is, the institutional limits constraining PSB's potential to bring meaningful information on a full range of events and opinions to the audience. This is not to say I sympathised with the then fashionable Leavisite attack on the media -- as in Denys Thompson (1964) or, more curiously, in elements within Hall and Whannel (1967). Obviously, as a media worker I was much more in tune with the anti-elitism of Hoggart (1958) and Williams (1963, 1964, 1966) and the celebration of Hollywood to be found *Cahiers du Cinema* and *Movie*.

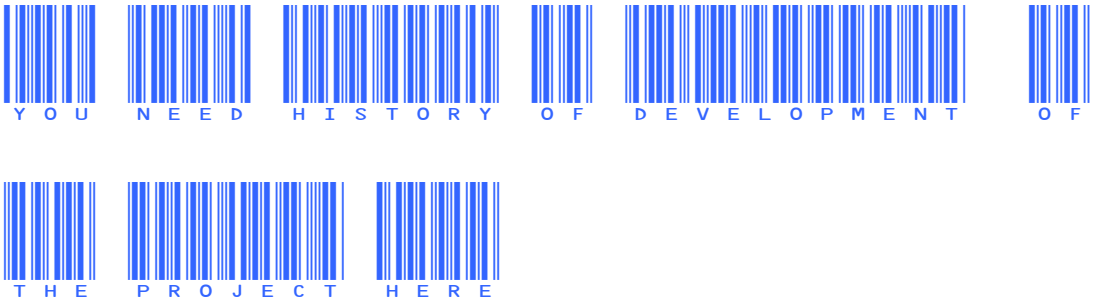
1.2.2. Assuming media sociology must have produced the insights I was seeking, my first approach was to examine what was the then to me hidden work of, for example, Klapper (1960), Schramm (1960, 1963), Halloran (1970) et al; but the media effects tradition in which they largely worked seemed extremely inconclusive and un-illuminating. Marshall McLuhan, with one of whose daughters I was to produce an extremely bad Canadian feature film, once asked me if I knew Wilbur Schramm. I said I did not and McLuhan said: 'Wilbur was the sort of a man who, if you asked him to define measles, would go round counting the spots on people's faces' – as good a critique of positivist media sociology as any. McLuhan's own work (1963, 1967), although -- as Jonathan Miller pointed out (1971) -- extremely important because it brought before a wide readership the then startling proposition that the media were worth studying at all, unfortunately seemed to me to be equally flawed especially in its cavalier treatment of historical cause and effect.

1.2.2. Another initial issue that concerned me was my own ignorance of the fundamentals of the mass media technology. Neither I nor the vast majority of my peers as producers, directors and researchers had any clear notion of how the medium actually worked and this ignorance, obviously

also shared by the public, contributed to the general ideological obfuscations around media policy and power. Technology, for example, was the key to the media's ideologically powerful claim on the real – a claim that was to also become a central concern of mine in that the scientific basis of broadcasting logically underpinned the objectivities on offer from the media. My sense,

which has not materially altered, is that concerns about media output in general and PSB in particular were a product of a certain insouciance about imaging and electronics as well as stemming from more obvious, and more discussed, editorial and other creative processes. An explanation of the technology and a critique of the sociology of the mass media therefore constituted the subject of my first published work (1973, 1974).

3.1.1. Although the work of the Glasgow Media Group had been informed by my professional understanding of production realities, the question of media technology, in the nature of the case, had not been foregrounded in the study. Therefore, after Glasgow, I returned to this topic. I had noted in my initial work on technology (1974) that the received histories of the development of the media appeared to follow a pattern of almost Proppian regularity. Apart from the inevitable appearance of a 'great man' inventor (they were, of course, all male) there was a curious precursor figure whose fate it was, apparently, to be ignored both at the time he (again, all were men) presented his innovative device and subsequently by history. The obvious explanation for this marginalisation, that the device did not work, was not inevitably the case, for sometimes the devices were indeed fit for purpose; conversely, nor was it true that the so-called 'invention' actually worked better or, indeed, very well at all. Furthermore, with many media technologies, after the fallow period following the work of this solitary figure there would be a sudden spurt of activity leading to the more or less simultaneous presentation of devices, one of which would be arbitrarily selected by history the 'invention'. This observation led me towards a revisionist history of media technologies (1986) and the elaboration of a theory of technological development prior to the moment of diffusion. This last, of course, was the subject of considerable attention in economic and business studies and was therefore not central to my interest. The pattern of change I elaborated sought to explain the phenomenon of 'invention' in terms other than the mysterious operation of individual creativity. This was represented in a revised and expanded form in *Media, Technology and Society* (*Published Text* **5/**1998) and is therefore to be considered here.



g) Further Applications

h)

i) Reception

3.1.4. *Media Technology & Society* (**5** 1998) has been reprinted five times was well received internationally. It was awarded the best book of the year prize by the American Society for History and Computing and was also favourably reviewed in the Times Literary Supplement by Bruno Latour. Outlines of the basic model have been reprinted a number of times (e.g. chapter 1 has been translated (2001) as "Ein Sturm von Paradies:Technologische Innovation, Verbreitung und unterdrüking/ Die Informationsrevolution als Hyperbel" in *Mediale Historiographien*. Other reprints have used different versions, e.g. the 1986 version has been used in (2000) *Electronic Media and Technoculture*, and another iteration (**3/**1996) was reprinted in (2000) *Film and Theory: An anthology*.

3.2.1. Latour's major critique of *Media Technology & Society* was that I had failed to deal with older media technologies, viz.: print, photography and cinematography. Actually I had been researching these histories and accounts (1990) and had demonstrated how the model applied to

these areas. A collection of previously published essays, *Technologies of Seeing* (3/1996) had brought together work on the technology of photography and cinematography which specifically applied the model outlined in *Media Technology & Society* with other work on the racism implicit in the colour film stocks (initially published in 1985) and the technological conservatism of Hollywood in opting repeatedly (gauge, sound system, colour system) for the most expensive technological options as a barrier controlling rival entrants. Further details of the development of 16mm appeared in Germany (7/2001).

3.3.1. Perhaps the most effective indicator of esteem is that the model for technological change original proposed in 1986 is the basis of the article, commissioned by Michael Schudson, on "Media Technology" in the *International Dictionary of Social & Behavioural Sciences* (8/2002).

j) Future Research

3.3.2. Some other aspects of this work have yet to be further explored. For example, the history of print as a technology is as yet unpublished but does figure in the more general history currently in press (*Messages*), albeit without direct reference to the model. A concern with the limits of the technological imagination, as seen, for example, in science fiction has yielded only one article thus far (2/1995) on *Blade Runner*. There has been a more thorough response to the technicist hyperbole surrounding the supposed internet/dot.com revolution of the late 1990s beginning with an evaluation of mistaken millenarianist approaches to these phenomena (5/1995; 6/2001). This criticism of dot.com hysteria melds with an equally oppositional approach to the issue of the supposed digital revolution in image making in general terms, for example in a 1989 article on HDTV which was reprinted in *Technology of Seeing* (3/1996). A more sustained body of criticism, however, bridges my interest in technology with concerns about the documentary and will therefore be dealt with below.

MEDIA TECHNOLOGY & SOCIETY

- A Klee painting named 'Angelus Novus' shows an angel looking as though he is about to move away

from something he is fixedly contemplating. His eyes are staring, his mouth is open, his wings are spread. This is how one pictures the angel of history.

MEDIA TECHNOLOGY & SOCIETY

- His face is turned towards the past. Where we perceive a chain of events, he sees one single catastrophe which keeps piling wreckage upon wreckage and hurls it in front of his feet.

MEDIA TECHNOLOGY & SOCIETY

- The angel would like to stay, awaken the dead, and make whole what has been smashed.

MEDIA TECHNOLOGY & SOCIETY

- But a storm is blowing from Paradise; it has got caught in his wings with such violence that the angel can no longer close them. This storm irresistibly propels him into the future to which his back is turned, while the pile of debris before him grows skyward. This storm is what we call progress.

Walter Benjamin

Notes

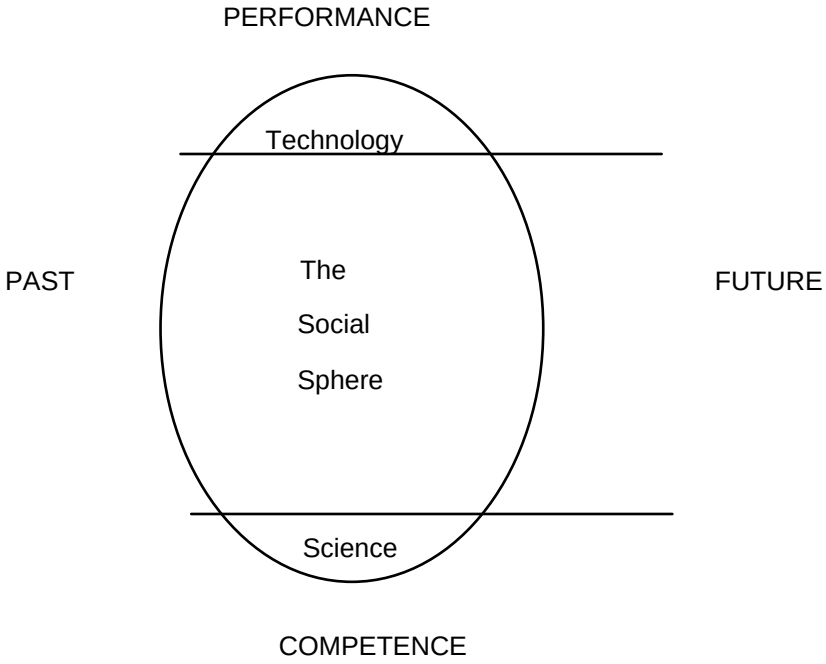
Appendix

3.3.1. The Linguistic Analogy

To achieve this balance, let us apply insights arising from another field of social study, viz. Saussurean linguistics.[8] This offers a useful basis for building a cultural determinist model of technological change in the media first because it too is grounded in the social sphere. It also has both historic (that is, in Saussurean terms, 'diachronic') and contemporary ('synchronic') dimensions. This duality is required to achieve an understanding of media technological change, too.

[8] Ferdinand de Saussure (1857 -- 1913) was a pioneer of modern linguistic study whose model of speech production is a source of the mid-20th century 'super-theory' known as 'structuralism'. The Saussurian concepts used here are drawn from the 3rd *Course in General Linguistics* which he gave in 1910/1911 and are known only from his students' notes.

DIAGRAM 1



Thus, the situation of any communications technology can be represented synchronically (in the social sphere) as the intersection of a diachronic body of fundamental knowledge (which might or might not encompass theoretical concepts and can be called, reverting to the original general sense of the word, 'science'); and the application of such knowledge 'in the metal' (as the engineers say, when actually meaning in any material, of course) – that is, technology.

Suassurian linguistics offers a further insight as to how the relationship of science and technology within the social sphere might be explained. Technology can be thought of as analogous to the concept of 'utterance' in linguistics. Utterance is a surface expression of deep seated mental competence which can be termed 'language'. Technology, therefore, is conceived of as a species of surface 'utterances' in a 'language' called science. Substituting the terms 'performance' for

'utterance' and 'competence' for 'language', as Noam Chomsky does when glossing Suassure, better explains the structural relationship of the two – 'performance' is the surface expression of deeper mental 'competence'. (Chomsky 2002 (1957)).[9] In the same way, technology can be though of as a performance of a competence arising from science (or knowledge). Technology thus stands in a structural relationship to science analogous to the relationship of utterance to language competence in linguistics.

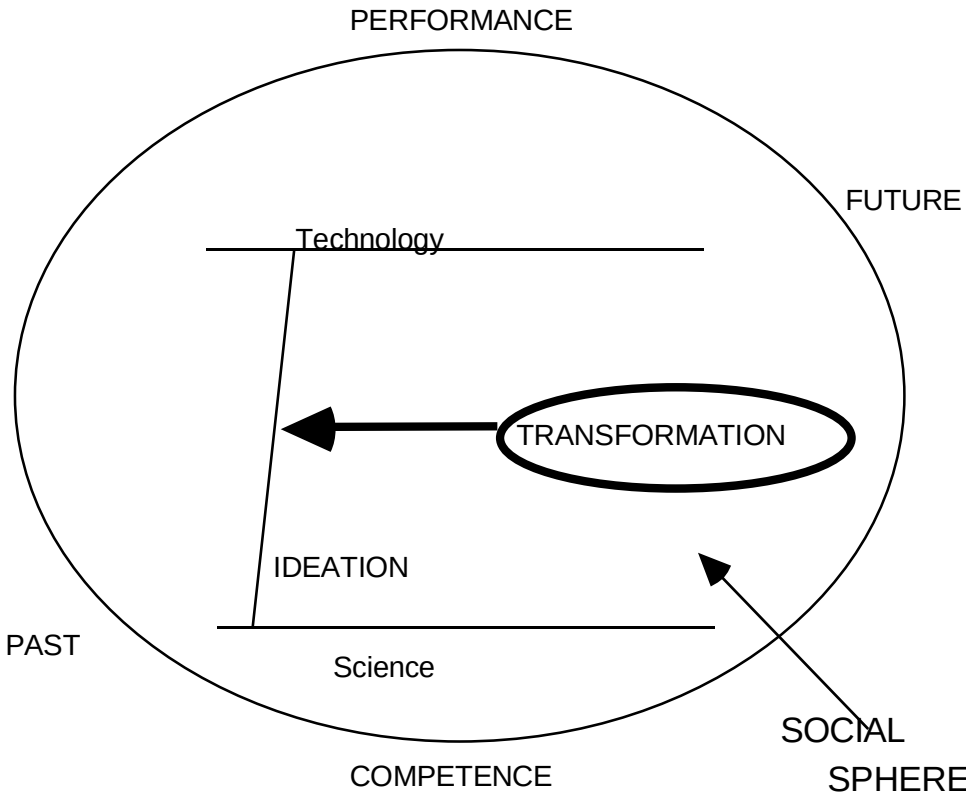
3.3.2. The First Transformation – Ideation

It is less useful to continue with de Saussure at this point because in linguistics rules (grammar) govern the transformation from mental competence to physical performance. The relationship between scientific competence (especially given we are using the term in the broadest sense of knowledge and understanding) and technological performance cannot be said, in any meaningful way, to be similarly rule-governed.

Nevertheless, a technology moves from inchoate scientific knowledge (which itself is conditioned by society) to wide diffusion in society via a number of transformations analogous to this basic linguistic transformation from competence to performance. First, the technologist (his or herself, of course, a product – in fact, a 'prisoner' -- of their culture) transforms 'scientific' understanding into an actual device.

DIAGRAM 2

[9] Noam Chomsky (b. 1928) is a leading scholarly linguist as well as being at the forefront of American radical political dissent.

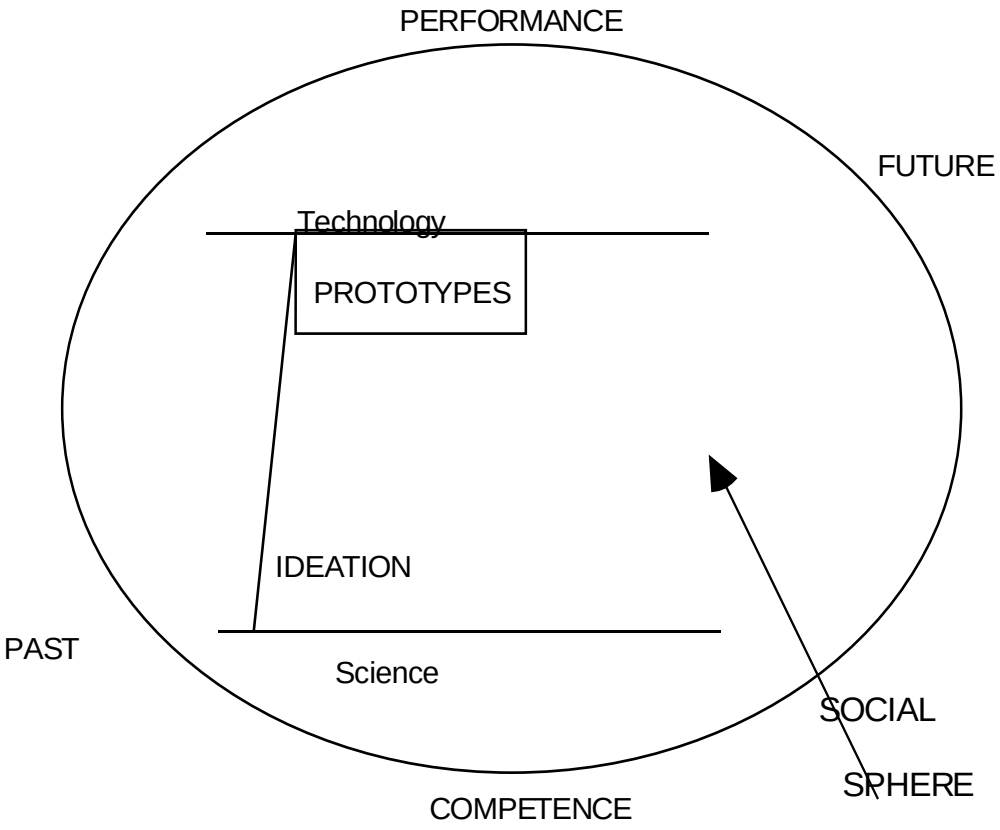


In the model of technological change we are building, this first transformation can be termed 'ideation'. The historical record is replete with examples of creativity envisaging technological possibilities, sometimes going back for centuries. For example, the idea of speaking over long distances was mentioned by Renaissance savants who clearly had little idea how to achieve such an effect beyond the fact that magnetism might somehow be involved. However , in the decades before the creation of an effective telephone (say 1830-1870), better informed minds were already grappling with the problem in a viable way. In the 20th century, the concept of digitalisation as a method of modulating an electric signal dates back, as theory, to the 1920s.[10] Sometimes, the technologists having these ideas were (and are) moved to take them a stage further and produce 'in the metal' a device which can be defined as a 'prototype'. 'Ideation' therefore produces technological performances which can be described as 'prototypes'.

[10] The theory of digital modulation was first applied to an actual piece of equipment in 1938, which therefore, in contrast to the technicist rhetoric stressing a contemporary 'revolution', marks the start of the digital age.

3.3.3. Technological Performance – Prototypes

DIAGRAM 3



Prototypes can be of four classes:
Obviously, they might not work very well, if at all. It is possible that, for example, the earliest attempts at telephones beginning in the 1860s did not function; or, if they did function, as did mechanically-scanned television in the 1920s and 1930s, they were less efficient than other prototypes being developed at the same time. Such devices can be termed 'partial prototypes'.

However, it is, perhaps surprisingly, *not* the case that the majority of prototypes in the media are ineffective. On the contrary, they are often as effective as the earliest examples of the technology that was eventually to be diffused as 'the invention'. For example, an effective device can be in existence, and indeed in wide use, for another purpose. In the late 19th century university physics laboratory there were a number of contrivances designed to demonstrate the validity of the wave theory of electromagnetic phenomena. These, which worked very well for this purpose, were eventually to form the basis of wireless telegraphy when that application came into play. Such devices can be thought of as 'parallel prototypes'.

A third class of 'rejected prototype' can be as effective (or nearly so) as the eventual solution at solving the technological problem but is eventually set aside and not diffused. For example, various static electric telegraphs dating back to the Napoleonic Wars were ignored because of conservative military and political opinions (both in comparatively liberal states such as Great Britain, for example, as well as in autocratic Russia). Despite the fact that these devices would have given significant greater signalling capacity than did the semaphore, military need was not sufficient to force through the change.

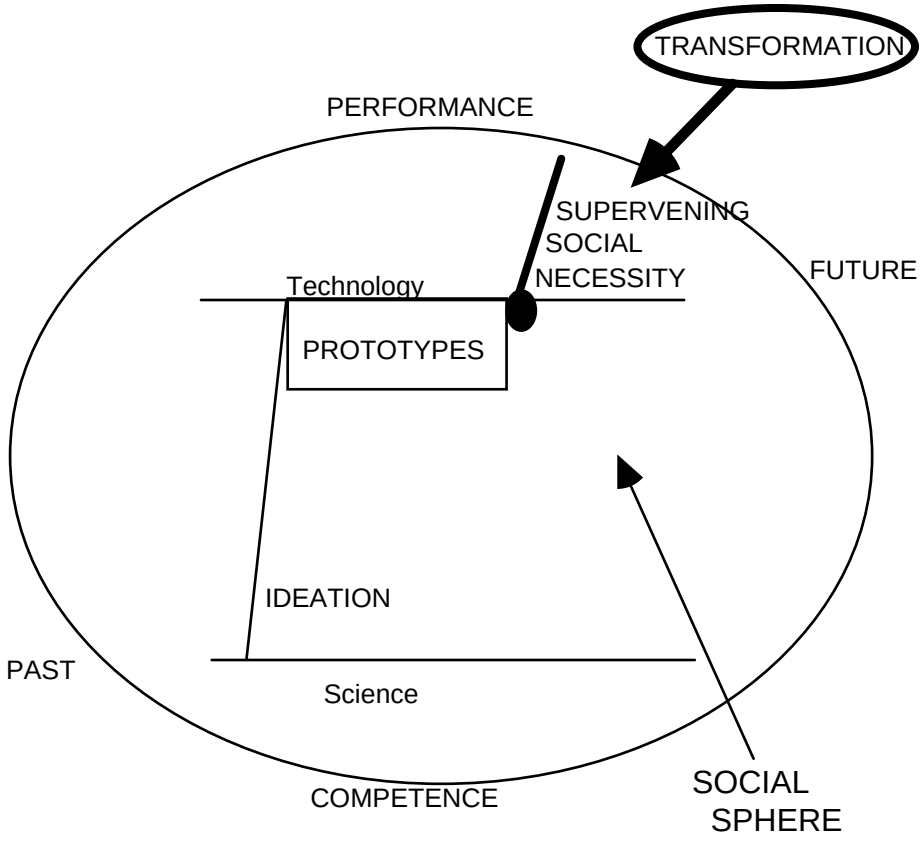
Sometimes, the prototype, although not the final, widely-diffused technological performance, can nevertheless be so effective that it does achieve a measure of diffusion and, indeed, can act as a brake on the diffusion of the 'invention' itself. An example of such an 'accepted prototype' would be large-volume, electric, Hollerith punch-card calculators, introduced at the turn of the 20th century. These were of considerable sophistication and were so widely diffused that they distorted research and development on the electronic computer in the middle decades of the 20th century.

Instead of a progression of prototypes, it is possible to read the development of technology as a 'cluster' of innovations, meaning that a 'technology' is in effect 'reinvented' as it moves towards full diffusion (Rice and Rogers, 1980) but this does not explain why such 'reinventions' occur, what prompts them and why only one is normally accepted as the 'invention'. Nor does such a view address Braudel's observation that technologies can remain unexploited for long periods of time, the 'accelerator' un-activated. In the model being proposed, the explanation for this phenomenon lies with the operation of a second transformation which emerges not from the enclosed world of the laboratory but directly from the social sphere.

3.3.4. The Second Transformation – Social Necessity

In this model, Braudelian 'acceleration' can be thought of as an external social force, or combination of such forces, acting on the production of prototypes. When these forces come into play, they transform the prototype into a device that is widely diffused. This second transformation can be thought of as the operation of supervening social necessity of one sort or another.

DIAGRAM 4



Supervening social necessity be roughly classified into three sub-types:

The least contentious of these is a social necessity occasioned by the activation of another technology. For example, rejected prototypes of effective telegraphs were produced prior to the supervening social necessity created by the instantaneous signalling needs of the railways. Devices produced after the widespread introduction of the railways were adopted as the 'invention' of telegraphy. Similarly, the new 'radio' or 'wireless' application of the parallel prototypes of the wave detection equipment lying around university labs was occasioned by the introduction of large 'Dreadnaught' ironclad battleships which, for the first time, steamed into action out of sight of one another, necessitating a new signalling system that worked beyond the horizon.

Equally well-defined is the second sub-type of social necessity. This emerges from the economic need of firms to refine and expand their offers in the marketplace. This creates for them a strictly commercial need to open up new markets with constantly revised or essentially new technologies. The operation of such needs has created technologies from Polaroid movies and 16rpm long-playing records to audio mini-cassettes and laser-disc videos.

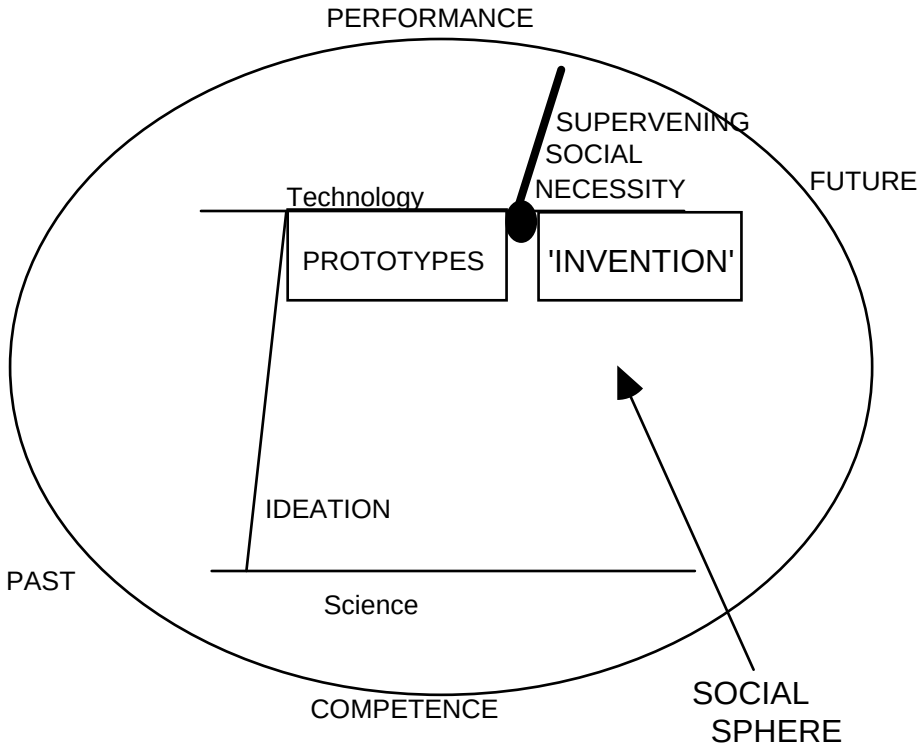
It should be noted that this is the least certain of the sub-types of supervening social necessities because although such commercially driven needs can be massively effective (as in the case of the CD or the mobile phone), they can also, as these other examples indicate, often fail. As consumers, although far from immune, we are less prone to fall in with corporate social necessities of this type than might at first be thought.

More contentious, because lines of causality are less easy to determine, is the third sub-type, a social necessity arising from society without involving either the demands of another technology or the desires of commerce. For example, the rise of the modern business corporation, a legal creation of the third quarter of the 19th century, created today's office, the architecture of the building which houses it and the key machines -- telephone, typewriter and calculator -- which make it function. All of these devices were either in existence or being developed prior to the 1870s but it was in that decade, as a consequence of the legal advances that produced the corporation, that these prototypes were effectively brought to market as 'inventions'. Similarly, entertainments from piano-rolls through radio to television can be attributed to the emergence at the turn of the 19th/20th century of an ever-increasing number of non-aristocratic homes housing a growing mass of Western urbanites comfortably enough to allow for leisure pursuits within them.

The operation of supervening necessity is independent of the technological performances which have been producing prototypes and this flow of devices does not stop. However, after the operation of this second transformation, a further prototype (as it were) becomes what is popularly called the 'invention'.

3.3.5. Technological Performance – 'Invention'

DIAGRAM 5



By locating 'invention' as a consequence of, or response to, a social necessity the phenomenon of simultaneity is also explained. Simultaneous 'invention', whereby more than one technologist produces the 'invention' at more of less the same time, is a common feature of media history. Given that technological advances in the media depend little, if at all, on the acquisition of new knowledge (or 'science'), the 'inventors' of new media technology are never 'eureka' pioneers experiencing blinding moments of insight, simultaneously or otherwise. Rather they are system engineers who are moved, in response to social need, to utilise available 'science', often old, widely known knowledge, to produce devices which are then designated by society as 'inventions'. The most dramatic instance of this simultaneity is that Alexander Graham Bell and his rival Elisha Gray both arrived at the Washington patent office on the same day, 14 February, 1876, with designs for an 'the electric speaking telephone'. Both knew the other was at work on an 'acoustic telegraph' and were quite consciously in a race; but neither was inspired by any knew knowledge of any kind. Why then, if they were not responding to the new circumstances

of business organisation in the later 1870s, were they both moved to tackle this problem? Effective dynamic electric telegraphs, radios, cinematographic cameras, large scale integrated circuits etc. etc. were also produced by many independent researchers simultaneously, leading to inevitable conflicts about primacy and patents.

Since the operation of a supervening social need is independent of the production of this flow of devices, its effect is primarily to facilitate diffusion. It does not require that 'inventions', technological performances subsequent to its operation, are actually more effective than the most effective of prototypes which preceded its operation. For example, patents existed for the use of magnetic tape as a memory or storage medium for electronic calculators from 1943. Such tape was easily a more efficient storage medium than those developed subsequent to the determination of a social need for a computer (essentially, the necessity of calculating extremely complex thermo-nuclear ignition problems). These included glass tubes filled with mercury, cathode ray tubes or nickel or iron-oxide plated metal drums which were said to be superior because they were not subject to contamination by dirt as the tape was. Yet this reasoning is spurious because within five years, by the early 1950s, tapes were being used, the apparent 'problem' solved by nothing more complex than dust-free cabinet housings for the tape decks (Winston 1998: 176; 187-8). The real difficulty, justifying ignoring the more efficient magnetic-tape prototype was, simply, that the tape was a German (indeed, a 'Nazi') technology and as such tainted in the years after World War II.

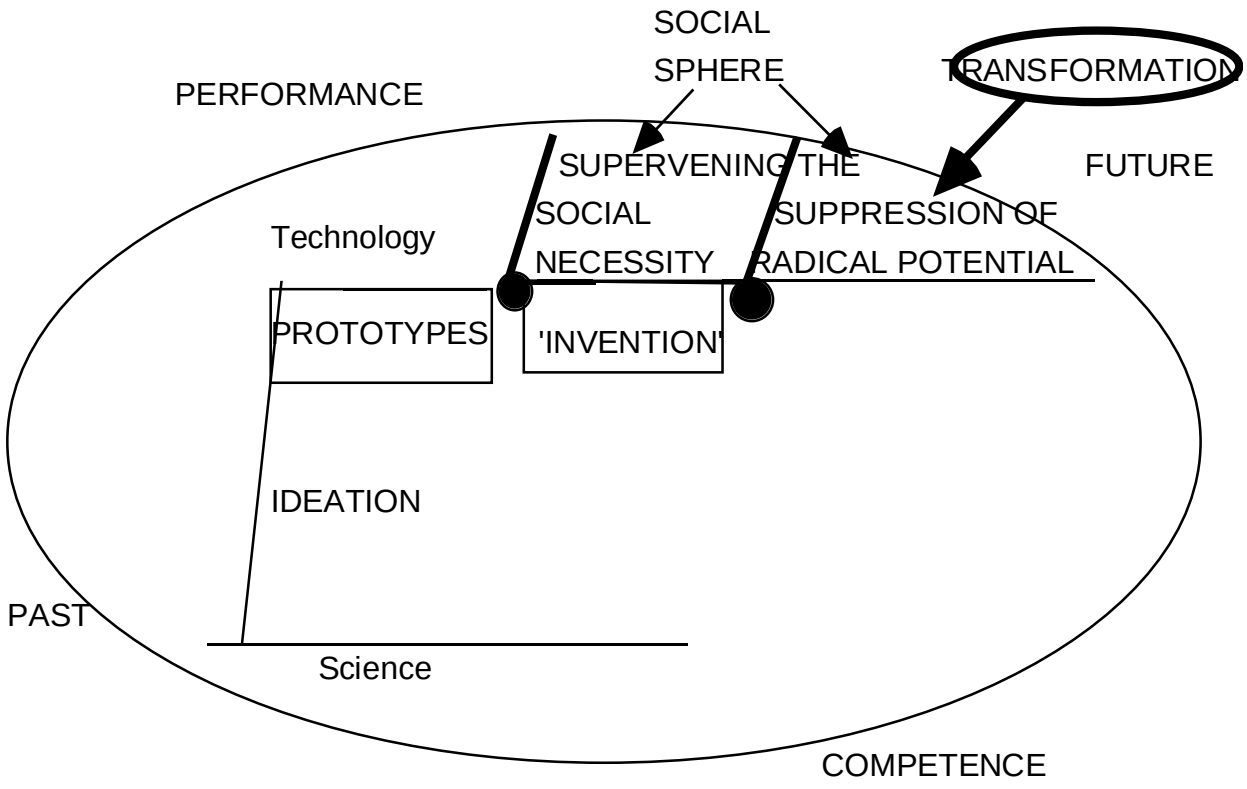
Conversely, it is occasionally the case that the 'invention' does not work very well at all. The device for which Bell was awarded the master patent for telephony did not work as well as that outlined that same February day by his rival Gray. In fact, neither Bell's vibrating magnet nor Gray's bowl of sulphuric acid (as described in the patent applications) was the solution, the actual 'invention' of the telephone. Instead, a period of intense research and development, conducted along lines that were to become commonplace in the 20th century, ensued. This effort involved a number of other technologists, notably Thomas Edison (in his laboratory, itself a prototype for the industrial lab that was to be the dominant site of technological research and development in the next century) and Emile Berliner. By 1879 these, and others, collectively produced the telephone as a diffusible contrivance. Bell, though, still held the master patent and remains, in the popular mind, the 'inventor' of the telephone.

3.3.6. The Third Transformation – Suppression of Radical Potential

As a cultural determinist, I would not dispute the basic premise of technicism that new technologies contain considerable disruptive power (for good or ill). However, since technologies arrive in the market as the result of supervening social needs or necessities, the disruption they can cause – at least in the West whence in essence they come -- is likely to be contained. It is, as the historical record shows, extremely unlikely to be in any sense 'revolutionary'. Because of supervening social needs, they will be widely diffused through (Western) society but they will, as often as not, nevertheless be heralded as agents of profound social change.

This is not to say that process of diffusion or adoption, despite the social 'fit' guaranteed (as it were) by supervening social necessity, will be without some greater or lesser measure of friction – Braudel's 'brakes'. In the model, this braking effect, even in a West dedicated to progress in general and *nuerungsfreundigkeit* (a love of new things) in particular, can be described as a third transformation, one where the power of a new technology to disrupt society, especially pre-existing formations of capital, is suppressed.

DIAGRAM 6

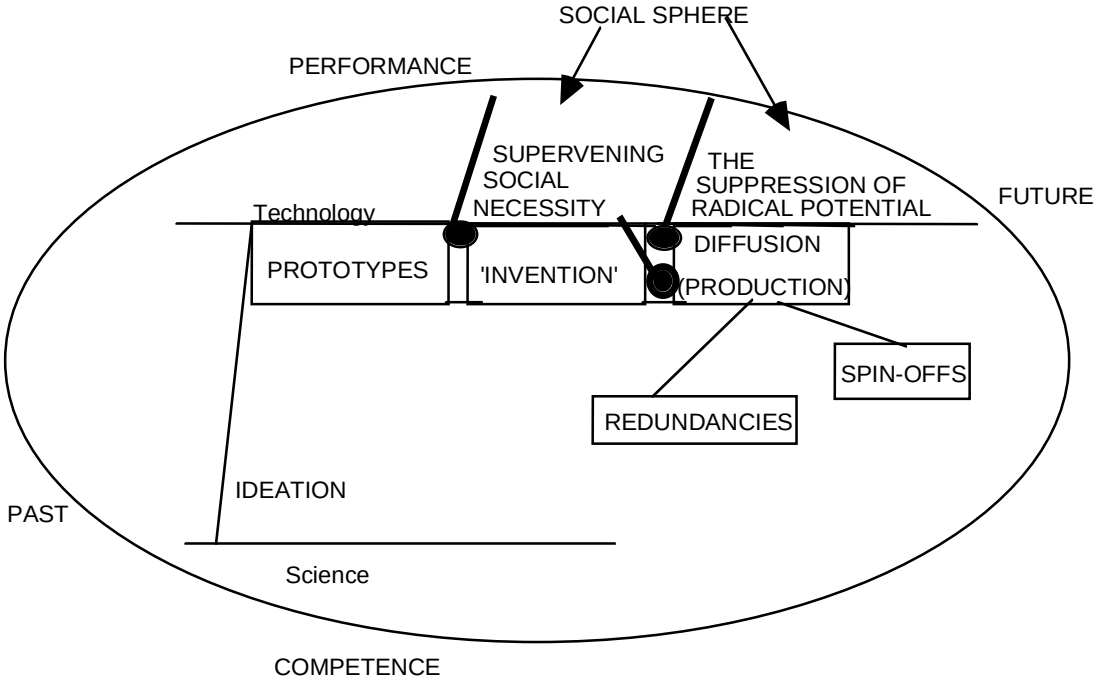


Suppression works against the *radical* disruptive social effects of new communications technologies. This does not mean that new technologies are never diffused (obviously they are adopted); or that they have no social effects (again, obviously, they do). But the suppression of radical potential is the price (as it were) for diffusion. Technologies, already determined by the social formation of technologists at the ideation stage and impacted by the effect of supervening social necessities are now, by the operation of the suppression of radical potential, further made to 'fit' into society.

Rather than privileging the impact of the technology, a cultural determinist approach will seek to understand how the effects of supervening necessity (the 'accelerator') interacts with the 'brake' involved in the suppression of radical potential. Balancing these two contrary social forces slows the rate of diffusion so that the social fabric in general can absorb the new machine and essential formations such as business entities and other institutions are protected and preserved – albeit not necessarily for ever. Despite the occasional instance of a case such as Eastman-Kodak, a corporation truly threatened by technological advance (in its case the digitisation of photography), the persistence of the great communication conglomerates attests that, the cut-throat nature of market place competition notwithstanding, companies are seldom if ever entirely wiped out. It is true that in the 1870s, the world's largest corporation was the Western Union telegraph company and although it is far from being a major player any longer it does still exist in an extremely profitable niche. Marconi's, on the other hand, is threatened with extinction but rather because of inept management than technological failure. It can be argued that, if anything, the 21st century market is dominated by a desire for stable trading circumstances, reinforced by external restrictions and monopolistic tendencies and these forces work to reduce the crudest manifestations of competition.

3.3.7. Diffusion: Production, Spin-Offs & Redundancies

DIAGRAM 7



New media technologies are therefore introduced between the accelerator (or the push) of supervening social necessity and the brake (or the pull) of the suppression of their radical potential. This conflict governs the nature and the pace of the diffusion of the technology. This final transformation heralds the last phase of technological performance, that of production. In contrast to economic analysis of technological change, the production phase is, for the cultural determinist, unproblematic. So determined has the technology been by social forces at every stage, it is bound to be adopted to one degree or another.

The creative process which has brought the technology through prototype and 'invention' phase to this point does not stop and technological performances yet continue either as refinements to the basic devices or, responsive to further social needs, as spin-offs. Spin-offs can be seen as the products of technological performance synchronous with, or subsequent to, the original device's diffusion. A focus on the initial technology can lead to the supposition that spin-offs represent some species of unintended or unforeseen consequence; but this is the result of failing to identify an appropriate discrete supervening social necessity. It is the case that the

supervening social necessity producing the microchip (military miniaturisation programmes in the later 1950s) was not the same as that producing the spin-off videogames which used those chips. Videogames were the product of a general social need for games, millennia old. Many technologies produced similar 'play' variants for the same reason – the printed playing card, the electric train set, any plastic doll. Audiotape is in like case as a storage medium for computing and a recording medium of moving images. These spin-off applications 'fitted'.

On the other hand, as with prototypes, the spin-off can be rejected as redundancies, applications already being met by other means. Polaroid Land's futile attempt to produce an instant movie system, as a spin-off from its instantaneous photographic system, in the face of the arrival of videotape would be a case in point. It was redundant, attempting to meet a social need for an instant motion picture system that was already being successfully met by tape.

Bibliography