

Technology and the Tradition of European Art Music

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I decided to make this available again 22 years after publication because I think its central argument still stands even if there are some dodgy components. It was triggered by the Pierre Schaeffer interview which appeared in the same issue of the Rer Quarterly. One of the things Schaeffer said was that, to explore sound, music has to explore music: from the point of view of music, sound in and of itself is of no importance... unless, that is, it's included into some kind of system in which sounds acquire musical value. At the time, I was sympathetic to this idea. Through my earlier (1984) attempt to analyze improvised music processes, I was already thinking of music as continuously defining and redefining itself through a particular kind of aesthetic work. Through this aesthetic work music also defined its attitude towards materials and processes, towards sound, towards instruments, in short towards everything relevant to its production. (To say that music 'does this', music 'does that', is a short-hand for the fact that ideas are formed in the activity of doing, so that musicians are formed by what they do and not vice versa.) However, in this article I'm not, like Schaeffer, defending music - seen as a tradition of using abstract schemas - from sound-work: I'm defending music - seen as an aesthetic activity - from technology. So I'm rejecting what I saw as the pre-Althusserian approach in which developments in the means of production automatically have socially (and therefore artistically) progressive implications. On the contrary, the technological complex of any society at any point in time is the result of social choices and so does not represent an objective maximizing of advantage in relation to natural resources. If this is true, then aesthetic activity *must* have a selective and critical attitude towards technological change.

T.H. 2009

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INTRODUCTION

In this article I argue that the direct impact of technology on composed music is, and must be, as negligible as it always has been. However, as I'll show, the indirect impact has been vast.

If I restrict my scope to the tradition of 'art' music within 'western culture' this is not because I don't see a great many connections with developments in other musical traditions. It's simply that time and space didn't allow me to draw them out. For the same reason, I've been unable to do more than hint at the theoretical basis from which I've

worked. Finally, readers will notice specific omissions - obviously relevant to the argument - such as any discussion of how technology, as a factor in the heard environment, the soundscape, has influenced the musical ear in such a way as to contribute to the shaping of 20th century music. So what is presented here is an incomplete utterance in the continuing debate on music and technology to which this magazine has given special attention.

Music is a world with its own history. Of course this history is partly determined by what happens outside the musical world, in the social, economic, political and technical worlds. But, like all art, music lives in the tensions between the particular culture which produces it and the higher-order nature-culture system of which this culture is one part. This means that the history of music can't be reduced to the history of its containing society, or, for that matter, to its own musical political economy and technology. So there actually IS a history of music, in which causal explanations, such as we can make them, will be to do with those changing intuitions, feelings and meta-perceptions of music-using communities which are not, and cannot be, directly semiologically articulated.

This aspect of musical history can be strongly illustrated by the fact that the essential character of modern music was formed immediately prior to the impact of electronic technology, and not following from it. This character is the resultant of two linked processes whose origins lie far back in what, at first sight, appear to be formal aspects of the musical world:

- 1) The escalating contradiction between *diatonic* and *thematic* principles.
- 2) The evolution of the use of *timbre* as structural information, and not just as a 'carrier' for information expressed in terms of other variables.

DIATONIC /THEMATIC

The term 'diatonic' describes the system of major and minor keys which evolved during the 16th century from the old system of ecclesiastical modes. In the new system, harmony achieved for the first time a significance of its own - not only, to begin with, in the sense of vertical chords, but also, increasingly, in the sense of horizontal sequences of chords. Henceforth the harmony itself could suggest directions of movement and return, a larger rhythm in the music.

Some of the initial impetus for the new system came from the new Protestant principle that the congregation itself should undertake the singing. The congregation not being expected to cope with canonic repetition of melodic phrases in simultaneous independent parts, composers had to solve the problem of producing simply harmonized chorales, in which all the voices progressed at the same time. A new connecting principle was needed for the vertical aspect of tones sounding together, and this was found in a stricter reference of all the tones to one predominant 'tonic' key-note. How does this differ from a modal system? Without going into great detail, we can imagine that a modal system implies the constant presence of a scale of notes throughout a piece of music written in that mode, but that this presence has a very low profile as an organizing principle. The harmonic conception, however, implies the presence of a vertical harmonic *structure*, a

hierarchy of simple and complex ratios between a fundamental frequency, the 'tonic', and higher frequencies. This vertical hierarchy is very fruitful for music because it suggests ways of organizing the horizontal movement in time between frequency ratios of simultaneously sounding notes, so that we can pass, for example, from simple (consonant) ones to less simple (dissonant) ones and back again. Furthermore, frequencies within the vertical structure built on a fundamental tone could themselves become new fundamentals, so that the pattern of frequency ratios could be shifted up and down. When we sing the same tune twice, but start the repeat on a higher note, we have in effect moved such a set of ratios to a higher frequency without disturbing its inner relationships. This is called *transposition*, and it is one of the important possibilities opened up by the diatonic system.

Gradually the diversity of the old modes (of which there were many) was abandoned in favour of the restriction to the two modern modes of major and minor. This restrictedness allowed a different kind of diversity, achieved by transposing the whole scale for different *tonics*, and by modulating from one key to another.

Finally, with transposition, it became a problem that an absolutely mathematically correct tuning for an instrument meant that it sounded out of tune when played in a key remote from its home key. Not until Bach promoted a new tuning system devised by J.K.F.Fischer, did we arrive at the modern tempered scale, in which every interval is slightly out in every key, but they all sound acceptable, and *all* the keys are *equally* in (and out of) tune. The alternative would have been to build, as Bosanquet did later, in the 19th century, such instruments as a harmonium with 53 subdivisions to each octave; difficult to make and play, and without even the reward of being perfect.

The diatonic system came to be the most widely accepted conventional system within our musical culture. Like the rules of the game of chess, the rules of diatonicism could be grasped independently from the way in which they were put to use in particular circumstances. But if you tried to explain the whole system logically, well, first you'd fail; and secondly, you certainly wouldn't be giving a true picture of how it grew up in history. And the import of this is that the diatonic system is a *functional* system - a system which is the way it is because of everything that people have wanted to do with it, and not because it expresses some perfect and permanent theoretical truth.

Consistent with this, the system embodies a number of working compromises between the demands of such different musical activities as:

- the recognition and analysis in human hearing of simple and less simple ratios between the frequencies of sounds. (This applies to sounds which have fundamental and relatively stable frequencies.)
- the production of sounds by means of the system of the physical activities of the body; the making of instruments as sound-producing systems which integrate into these systems of human physical movement.
- the composition of sound into multi-ordinal structures and processes related to their inner counterparts - activities of the whole mind.

The third of these, the activity of composition, is the leading dynamic force in musical history, the opening, as it were, through which not only immediate social demands but also developments of the human mind, welling up from the deep currents in society, come to bear on the growth of music. Connected to this compositional activity is the emergence of a tradition of craft, of skilled work with materials - skill which is second nature in the sense of being an activity of the whole mind. Within this tradition, through the collective furtherance of the craft, originates the movement to make structures of greater multi-ordinality and to forge a means of composition capable of producing them. So it is the compositional activity which pushes from the mode-system to the diatonic system, and which later pushes aside the compromises of the diatonic system when it no longer meets the demands of an intensifying thematicism.

The tension between thematic and diatonic is immediately present when we recognize that they are not only different things, but different *kinds* of thing. A theme is, by its very nature, connected to the local individuality of single pieces of music. Tonality, in contrast, is precisely what refers individual pieces of music to a global system.

A theme is an important sub-organization, lying between single notes, on the micro level, and the over-all compositional structure, on the macro level. As themes are already organizations of smaller units - individual intervals between notes, and also groups of intervals - it's possible to restate a theme whilst varying it in some respects and not in others. As compositional activity intensified, this 'theme and variations' idea became less and less a matter of fanciful and decorative elaboration; composers sensed that there could be a structure in time such that the succession of variations itself expressed a musical logic. Hence the concept of 'thematic process', first expounded by Rudolph Réti - an idea which sums up the essential technique of the Beethovenian period and whose later branchings extend right through into the work of Stockhausen and others. This new awareness came through a new interest in instrumental music (the 18th century symphony) and a search for ways of incorporating what had previously been explicitly *dramatic* - in liturgy and opera - into purely *musical* structure. And in the background was a new sense of time itself - a rising dynamic and expansive world view which opposed itself to the feudal and clerical dogmas of the old order.

In sketching the origins of the diatonic system I noted the increasing predominance of harmonic relationships over the 'free' movement of parts. However, the impulse towards free melodic movement of parts remained a living force in the music and again became prominent with the evolution of thematicism, which was fundamentally a melodic concept. The difference now was that thematicism provided the means to organize melodic development through the combination and recombination of the melodic cells making up the themes.

Yet the development of each theme, following the principle of expanding its inner structure outwards, constantly came up against another principle of organization which functioned specially in terms of the vertical arrangements of the parts, but also in terms of imposing an over-riding relationship of all the tones to one key-note or tonal centre. The coexistence of two unrelated organizational principles in one field became an

increasingly severe aesthetic problem.

The need to confirm tonality demanded that transposed melodic material be adjusted to stress intervals consonant with the tonal centre. The need for thematic consistency demanded the opposite - namely that the melodic development through transposition should keep its exact identity. In this field of tension between two principles, dissonance - the sensation of an unblended sounding together of two or more tones - came to be not so much a negative, as when heard and used *tonally*, as an affirmative, as when heard and used *thematically*.

This liberation of the dissonance is quite different from the chromatic use of dissonance for colouring tonal harmony and for effects. I associate chromatic dissonance with the late romanticism which immediately predates the break with tonality. If romanticism intuits the formal inadequacy of the cultural systems available to it, yet fails to revolutionize the form, falling back instead on the trope of inherent inadequacy of form itself, 19th century musical romanticism gives us the whole tendency of clinging to tonality whilst simultaneously over-burdening it by piling on chromaticism and extremes of modulation.

For those who, uncompromising, lived through the crisis of the tonal system, the aesthetic tension described above became a struggle between an internal, individual necessity, and an external, global, restrictive system which had outlasted its time. Unsurprisingly, the music of this period found a parallel in expressionism and other related ideas. The polemic tracts of the period, the Busoni manifesto of 1907 for example, drew into musical discourse a poetic of liberation which was widely expounded at the time. We find a tendency to reify the inadequacy of inherited cultural systems by characterizing the inexpressed part of life as an inherently autonomous zone, a subconscious, an id. On the one hand were the exhausted grammars of socially approved expression. On the other beckoned the unconscious, a dark and dangerous instinctual world, intense, violent, inchoate: the world of psychodrama, of Schoenberg's *Erwartung*, of musical dreams.

THE LIBERATION OF TIMBRE

If 'sound' means physical sound as a whole, in all its aspects, 'timbre' refers only to a part of sound - the residue which is left if you take away pitch, volume and rhythm. Technically, timbre would include all the micro-aspects of sound: starting transients, envelope, harmonic spectrum, etc. Perceptually, it strikes us as a unified tonal quality, the mark of a sound that tells us that it is what it is - like the quality of a human voice that tells us who is speaking.

Within the diatonic system, musical composition is largely a matter of organizing pitch and rhythm. The system itself has little to say about the organization of timbre, which is therefore treated rather haphazardly. It was standard practice in the 18th century for music to be sold in bunches of separate parts and without an orchestral score. Many title-pages bore remarks like 'double-basses, trumpets and timpani will greatly add to the effect of this piece'. The organization of timbre was therefore placed largely in the hands

of the conductor or the director of the particular orchestra for the particular occasion.

Moreover, the timbres available to the composer had evolved in ways that had little to do with the development of tonality and a great deal to do with the interaction of human physiological systems with the changing technology of sound-producing systems. Technological change proceeded at a very uneven pace with regard to the different types of instruments. For example, the slide trombone by 1500 looked much the same as today, whereas the woodwinds had to wait for the 19th century for the big step forward in mechanical key-work. Prior to the emergence of the modern orchestra, different groups of instruments developed quite independently due to their different dynamic characteristics and their consequent suitability for different social occasions in different kinds of acoustic environments. Church-building typically involved the use of acoustically reflective materials to build large structures with high ceilings - ideal conditions for a reverberant sound which smoothes out problems of intonation. So the liturgical context was good for the relatively loud and quirky wind instruments, as supports to human voices, whilst the acoustically dry and socially less participatory ambience of the 'chamber' and its music suggested the refinements and reticences of the strings.

The musical system required increasingly accurate intonation and uniform quality, but did not rationalize tone-quality, or timbre, itself - even where you imagine it would have been easy to do so. The string section in the modern orchestra contains violins, violas, cellos and basses. The ratios of the pitches and the sizes of the instruments conform to no rational order, the viola being only 15% larger than the violin, though its pitch ratio is 2:3. My point is of course not that I would have wished the string section to be homogenized, but that the musical system didn't seek to organize the variation it preserved.

Nevertheless, despite the unrationalized character of timbre use in much tonal music, we can trace the movement to develop the structural use of timbre back to the origins of the modern orchestra in the Mannheim school, and the concurrent emergence of thematic process.

The connection between thematics and timbre use made itself felt from the start. The demands of a more sophisticated thematicism simply required the use of timbre to clarify contradistinctions of thematic ideas. In the end, thematics made the whole harpsichord continuo idea redundant. The evolution of the textural variety of modern orchestration derives from its influence. Yet the fact that this great expansion in the scope and sophistication of timbre use was driven forward by a thematicism explicitly only concerned with pitch and, to a lesser extent, rhythm, shows yet again the true picture with regard to the position of timbre in the old musical system.

Against this background, the breakthroughs of the early 20th century are decisive. In their challenge to the hierarchical system which preordains by a kind of universal decree which musical variables should be the most significant, they open the door for the liberation not only of timbre but of all musical variables for structural use.

These breakthroughs are, essentially, three in number:

1) The development of *Klangfarbenmelodie*, or the melody of timbres, where pitch is subordinated to timbre; traceable from Berlioz, through Mahler, and into Schoenberg and Webern - where it becomes the impulse towards total, integrated organization of all the musical variables - a project taken up by Stockhausen and Boulez. A landmark, perhaps, was Schoenberg's note in the score of the third of the 'Five Orchestral Pieces' of 1909: 'The change of chords in this piece has to be executed with the greatest subtlety, avoiding accentuation of entering instruments, so that only the difference in colour becomes noticeable...There are no motifs in this piece which have to be brought to the fore.'

2) Varèse set off firmly and unambiguously in a new direction, in which a whole composition could be built on the supremacy of timbre and rhythm over pitch. Lecturing on the new music at Santa Fe in 1936, Varèse said: 'The role of colour or timbre would be completely changed from being incidental, anecdotal, sensual or picturesque; it would become an agent of delineation, like the colours on a map separating different areas, an integral part of form. These zones would be felt as isolated, and the hitherto unobtainable non-blending (or at least the sensation of non-blending) would become possible.'

3) Ives created a musical soundscape using ready-made chunks of his musical culture - complete with their social and occasional connotation, their expression-marks, rhythm, tempo, and, often, tonality. Composers had always borrowed material, but none had yet made it the core of their compositional thought. Ives made a radical attack on the nature of musical unity as it had been conceived up to that point. He also demonstrated the utter freedom of method available to composers who, by choice or circumstance, stood outside the old musical system.

THE MOMENT OF CHANGE

In this brief history, I've been concerned to outline the most important developments which culminated in the end of the global system and the liberation of all the perceptible variables of sound as structurally informative. These decisive changes establish the essential character of modern music prior to the impact of electronic technology. I imagine that each of the three breakthroughs outlined above corresponds to, and predates, important areas in which technology later entered music. *Klangfarbenmelodie*, linked to the idea of the series as an organizing principle, calls forth the use of the computer as a compositional tool. The timbre compositions of Varèse demand the synthesizer as the means of breaking out of the restrictions of the traditional instruments. The superimposed sound-layers and 'found musics' of Ives evoke the possibilities of the tape-recorder and of the sound recording medium as a compositional resource.

Looking at these relationships, you might imagine that technology has helped push forward and consolidate the achievements of the early 20th century. Is this in fact the case?

In pragmatic terms, technology now lays before the composer the means to carry out all imaginable musical projects. Yet this imagination, this freedom, is a function not of the

available means but of the necessities of the evolving compositional craft. Music is not a technical activity per se, but, as I've argued, a special kind of activity, with its own needs and values. A strong musical tradition must know itself, stand on its own two feet, and assert its needs clearly and confidently - taking whatever meets its demands and rejecting whatever in the world is useless to it or against it.

As I look and listen around me, it seems to me that this is not a description of the current state of affairs. I have, instead, the impression of an invaluable precious territory that has been surrendered without a struggle, by a kind of voluntary self-trickery. This loss takes the form of a large-scale and general capitulation to ideology, arising partly from an intensifying pressure from outside, and partly from inherent weaknesses.

So far as the inherent problems go, the shattering of the tonal system created a vast theoretical shock-wave, a loss of faith in the continuity of musical craft. If craft retreated, ideology rushed to fill the gap. There was an attempt to instate the '12-tone method' of composition, developed by Schoenberg, as a new global system for music. This would produce a new conformity, and new untrue values, whereby music was good so long as it had been made by the 'correct' method. Schoenberg himself saw the dangers clearly. Hearing of the vogue amongst young composers for the 12-tone method, he asked 'Do they succeed in writing any *music* with it?'

Parallel to this youthful conformity was the struggle of the musical establishment to reconfirm its position as a cultural church with power and privilege - not to undergo a decentralisation to match the new musical relativity, but rather to find a new sacred text. Finally, and I now completely link the inherent and external factors, the new sacred text was to be the meeting-point for, on the one hand, an extreme thematicism, which had been sundered from musical craft, and, on the other, a scientific ideology generated in the wider society.

I could say that an intensifying ideological pressure from outside caught the musical world in a moment of weakness. Of course ideology has always been at work in music - I've already referred to romanticism and expressionism, but these are not techniques so much as styles or world-views. What is new is that ideology now pretends to produce an actual method or technique for music. Far from music being liberated by the *pragmatics* of technology, it had been enchained by the *poetics* - the ideology of the machine. What is this ideology of the machine, and how does it affect music?

THE POETICS OF THE MACHINE

The opening gambit for any ideology - its announcement of itself to the world, as it were, is to deny that it is ideology. When Stockhausen pronounces that machines are 'an extension of nature', he tells me, above all, that he's choosing to ignore the dimension of social power - which arises in the fact that every machine is the product of a particular society and political economy. There is, I think, no other way to explain the extraordinary naiveté of the musical world's uncritical infatuation with machines, except in terms of this refusal of the truth, which is, when it comes down to it, a political decision.

The ideology of technology is the most far-reaching ideology yet developed in the struggle of the present form of society to present itself to us as both necessary and supremely rational. The message is that there is no issue, no problem, no value that can't be technicized - that is, reduced to the terms of a simple closed system over which complete control is possible. Technicization is peculiarly inappropriate to musical activity because music is, by its nature, concerned with the integrity of complex higher-order systems.

I've already mentioned the impulse to replace the old diatonic order with a completely rational and total method of composition. This attitude encourages the atomization of musical materials into very large numbers of imperceptible sub-elements, which can then be coded into computers and subjected to mathematical and statistical procedures. These reductive atomizing processes bear no relation to the holistic and formative structures and processes of musical life. Unsurprisingly, the results often have to be appreciated as illustrations of the theories that produced them.

A further aspect of technicization is the utopian 'merging' of musician and scientist which is proposed *a priori* without any attempt to grasp the specific needs and values of music. I quote a recent Yamaha advertisement: 'As music and technology become synonymous with one another, the roles of artist and engineer become increasingly fused. The old idea of the recording studio gives way to the concept of the totally integrated environment. Here the line between instrument and processor becomes indistinct.' This imaginary meeting takes place under the aegis of both the State (as at IRCAM) and the Market (as at your local 'state-of-the-art' recording studio). Clearly there is no question of a real meeting - real in the sense of a mutual recognition of needs and values.

To illustrate the current composer-engineer relationship, here is a comment made to me by Barry Anderson – electroacoustic composer and teacher, founder-member of EMAS and instigator of the West Square electronic music studio: 'The situation now is that composers don't have much influence over what the machine-builders produce. The technology is so far in advance of the composers' invention that they are left with trying to assimilate, and to work within, the particular orbit presented to them by a particular machine. It's the technology which throws up the new possibilities. Who could have imagined the development of an elaborate pitch-shifting device until it actually became technically feasible to do it? Then composers pick it up and say "Gosh, this is marvelous'...'

Compare this with Cecil Clutton discussing Cristofori's prototype piano of 1709: 'Its early neglect shows that when an instrument-maker invents something before the composer is ready for it, his rewards will be slight...not until Mozart began to write for and play upon the instrument in the 1770's did it gain any wide recognition.'

Once music remodels itself on science, it begins to deal with an objective and material universe, a world of sound considered not in terms of its aesthetic qualities, but in terms of its physical properties. As a branch of Cartesian physics, music no longer deals with

forms and evolutions but with particles and incremental changes.

Not content with redefining itself in the present, the new music must also redefine its past. The era of traditionally notated music becomes pre-scientific. Composition in the scientific era is conceived as a 'concrete' activity of sound-processing. That which is 'concrete' is factual, scientific, authentic and even proletarian. That which is 'abstract' is illusory, unreal, inauthentic, bourgeois. The inauthenticity of 'abstract' composition is given in the phrase: 'Art musics...are produced and reproduced primarily through the EYE' (Chris Cutler, *Re Quarterly*, vol 1, no 2, p 28) . Against this, consider the following arguments...

Music is by its nature not confined to ear-work, but is directed out from, and in towards, more generalized activities of the whole mind. This fact underlies the well-documented synaesthetic tendencies, and indicates that there is no inherent contradiction in integrating activities of different sensory modes.

The fact that music is written down does not mean that it was not first worked on as *imagined* sound. The heart of all compositional technique up till the present day has been in the development of the inner ear - the ability to imagine and organize sounds in the mind precisely and extensively. The nurturing of this skill is facilitated by cross-referencing between two different sensory modes with the use of a visual system of notation for auditory structures.

Only when inner hearing is undeveloped relative to notational skill can music be said to be produced primarily through the eye. Certainly, from the 19th century onwards, there have been those musical pedants who turned counterpoint and harmony into 'paperwork'; but there is, surely, no need to condemn the whole because of the (rather obscure) part. The truth is that, for the composer, it is the inner ear, and not the outer ear, which is the principle domain. Think only of late Beethoven.

If the term 'concrete' has anything other than an entirely banal meaning for art, it refers to the resistant and intractable quality of materials and their consequent friction with the imagination. Without such a friction, no artistic process is possible. There follows from this the irony that, by reducing sound to a substance which is (according to the adverts) utterly obedient to every whim of the imagination, the new technology actually threatens to abolish the concrete in music.

The change from the global diatonic system to an open field of thematic potentials does not signify a change in our understanding of the physical nature of sound, but a change in the functional priorities of composition. Music has not suddenly departed from a subjectivist 'abstract' view of sound and arrived at an objectivist 'concrete' view. The opposition and dialectic between sound and structure remains exactly as before; it is simply that every available aspect of sound can now be brought into structural use.

To complete this discussion on the ideology of technology, it's necessary to say a little about how this has affected the position of the composer...

Varèse wanted to seize technology as a weapon in his fight for the liberation of sound and for his right to make music with all and any sounds. He saw immediately that we could get rid of the tempered scale and the steady beat. Yet the opposite has happened. The leisure industry has seized the technological means and imposed more than ever before the tyranny of the diatonic scales and the regular pulse.

Composers have, in specific instances, asked synthesizer manufacturers to provide freely tunable keyboards and indeed alternatives to the keyboard itself. Designers have replied: 'We'd like to, but there's no market for it...' By and large, however, the musical world has itself willingly acquiesced in reorganization from the outside, from market forces and state subsidy. Today's composer is typically successful, a member of the top social bracket, and this is reflected in the music. Technology is no longer a weapon or a challenge, but a comfort, a labour-saving device. The imagination has been declared 'free'. The furnace of aesthetic discovery has been recast as a comfortable living-room. The composer is content and receives a new commission for the opening of a motorway or power-station. Content, finally, to inhabit one half of an intensifying contradiction, to be the mystical icing on a poisonous cake.

On the subject of this poisonous cake, consider also that the political economy of the electronics industry centres on the capitalist drive to concentrate skilled work into the hands of a very few well-paid specialists and designers whilst switching production work to third world countries, where labour costs are held down by quasi-fascist governments. In the UK, where unions still count for something, information technology 'may not be able to survive as a serious independent industry' (National Economic Development Office, September 1984). By the end of 1985, the only UK electronics company popular in the City was Amstrad, who make their computers in South Korea. My favourite news-item from South Korea this year is from the Guardian of 11.11.86: 'It was revealed yesterday that S.Korean police fired 313,000 teargas shells to quell student unrest in the first 9 months of this year, at a cost of US \$6.8 million (£4.5 million). According to a police report to the National Assembly, this is 53% more than the figure for the whole of 1985, when police fired 204,481 shells. '

CONCLUSION

In this discussion of the impact of technology on music, I hope to have shown that the ideological impact has been very large and that the pragmatic impact has been over-rated. This over-rating would follow automatically from the fact that, once music is defined as a technological activity, then technological change - which is, by definition, progress - must entail musical progress. My feeling is the opposite. The explosive developments of the turn-of-the-century period laid extraordinary challenges and potentials before today's would-be composers. These challenges have, by and large, not been taken up. This failure arises from the ideological exploitation of genuine technological advances by an increasingly ideological society, whose growing hunger for falsehood is proportional only to the enormity of the truth it has to hide.

If I have described a dialogue between musician and technologist that did *not* take place, then a prerequisite for this dialogue really to begin is that both technologists and musicians must shake off their roles as ideological functionaries and enter the arena of politics as themselves, and not as technocrats and musicrats. This means: refusing the prizes offered by the social order as it is; denying the class society which generates ideology to disguise and justify an uneven distribution of social power; affirming a meta-social order which disperses social power, freeing the productive and creative capacities of humanity. To imagine, to desire, to act, these will be the crucibles in which outgoing ideas, images and languages are tested. And if such ideas, images and languages come together, form coalitions, grow into systems and meta-systems, then these systems will be sustained only by their effective fluency, their truth to their source, and not by their usefulness to social groups seeking power over others.

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