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ABSTRACT

From the close of the nineteenth century and into the early part of the twentieth century, three aural technologies--the telephone, the phonograph, and the radio--were rapidly disseminated throughout the United States. These technologies brought to the population more aural information than it had ever experienced and created a new environment of structured and meaningful sound. This environment led to a change in perception of sound by those most sensitive to cultural shifts in aural phenomena: the avant-garde composers. Major composers such as Stokowski, Varese, Chavez, and Taylor articulated significant dimensions of this shift with dramatic expressions of their own changing notions of sound, their personal reactions to the new media, and their hopes for an "aural awakening." They pointed to radio, the "new musical instrument," as a source of new relations to the world of sound which, suddenly, was "vastly freer." The aural media altered their notions of tonal relation and the very concept of "natural sound." Commentators claimed that the phonograph and radio were inaugurating a social musicalization of sound. With the cooperation of Bell Telephone Laboratories, Varese and Stokowski sought to use radio to extend to the absolute perceptual limit the public's awareness of all aural phenomena. (FL)

History Division

THE PURSUIT OF SOUND:

AURAL MEDIA , PERCEPTION, AND THE COMPOSER IN THE EARLY TWENTIETH CENTURY

by

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In 1894 just before the dawn of the century, a prominent painter, a physicist, an anthropologist, and a writer sat sipping champagne at a Glasgow inn. Each man, from his own special perspective, took his turn to gaze out at the twentieth century and report to the others what he saw. Octave Uzanne, an American writer and journalist, saw about him the portentous rise of a new communication technology. In the new aural technology that was slowly diffusing throughout America, he perceived the death of print culture:

> Printing which Rivarol so judiciously called the artillery of thought, and of which Luther said that it is the last and best gift by which God advances the things of the Gospel - printing, which has changed the destiny of Europe, and which, especially during the last two centuries, had governed opinion through the book, the pamphlet, and the newspaper - printing, which since 1436 had reigned despotically over the mind of man, is, in my opinion, threatened with death by the various devices for registering sound which have lately been invented, and which little by little will go on to perfection...
>
> Our eyes are made to see and reflect the beauties of nature...I like to fancy someone will soon discover the need there is that they be relieved by laying a greater burden upon our ears.[1]

What Uzanne uneasily sensed were the faint early rumblings of a major perceptual shift in the culture. Three aural technologies, the telephone, the phonograph, and the radio were about to bombard the ear with more aural information than had ever been experienced in the history of man. A whole new environment of structured and meaningful sound was being constructed. Among th first to sense the change

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[1] Octave Uzanne, "The End of Books," Scribner 16 (1894), p. 224.

were those who worked daily with percepts and with communication, the artists. Uzanne was an artist deeply linked to print and visual culture. In the new infant aural technology, he saw a threat to his major means of disseminating information.[2]

By the 1930s the muted sounds noted by Uzanne had become the urban blare of modern radio. Most noticeable in the cable was the omnipresence of music. Print had not died as Uzanne had feared. But as he had predicted, the ear was now a more active processor of information. An artist deeply committed to the new aural technologies, Leopold Stokowski, confirmed the consummation of the perceptual change that Uzanne had only imagined. As a composer and conductor, Stokowski saw a change that challenged the very fundaments of music:

> It may perhaps be a revolutionary and unwelcome idea to some that the definitions of sound and of tone that have held good for a long period no longer are able to limit the possibilities of music and sound. But there have been gradual and apparent sudden changes of centre like this in other spheres of our life and experience. For example, the changing of theories of the solar system issued the same challenge to men of various ages...
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> The facilities of wired transmission extend these possibilities enormously. Now they are really only limited by the intake of the human ear and by the brain centres to which the ear reports and in which the sensation of sound are received and in some way changed into emotion, mood, and

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[2] The phonograph figured prominently in a number of futurist visions. For classic examples of phono-futurism, see Thomas Edison, "The Phonograph and Its Future," North American Review 126 (May 1878):527-536; Uzanne, op. cit.; Edward Bellamy, Looking Backward, 2000-1887 (New York: Regent Press, 1887).

states of being.[3]

It is clear that in the upper circles of music composing, a generalized perceptual shift was also being experienced as a radical paradigm shift.

If Stokowski's and many other's observations were right, what then may have been occurring in the culture? Perception is not an invariant property of human beings but is significantly molded by the psycho-cultural environment in which and through which the individual perceives. A particular sensation does not enter consciousness isolated and independent. It is always part of a system of schematic or semiotic relations, perceptual expectations, selections, and transformations.

Therefore, the world is not really perceived; it is modelled. These models or perceptual schema arise from an intricate interaction of the genotype with culturally sensitive variations of the phenotype. As soon as perception moves beyond an indication of the absence or presence of a physical phenomena and enters into the realm of meaning, it becomes part of higher cognitive processes associated with semiosis. The ascertation of meaning involves much more than simply assigning a denotation to a sensation. The percept must be isolated from the flow of sensation, it must be placed with a system of relations and oppositions, and then integrated into more complex and intricate clusters of meaningful percepts. As we would expect, there is

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[3] Leopold Stokowski, "New Vistas in Radio," The Atlantic Monthly 155 (January 1935): 9-10.

some evidence of cross-cultural variation of pictorial perception, sensitivity to perceptual illusions, and complicated variation in perceptually related classification systems.[4]

Intraculturally, there also appears to be evidence of changes in semantic processing over short spans of time. These changes are said to take place in modern industrial societies and may be caused by the rapidity of sociological and technological change and the heterogeneity of physical and social environments. An anthropologist turned communication researcher, Mallory Wober, is attempting to link generational variations in media use with variations in mental imagery and processing strategies. These intracultural changes provide preliminary indications of ongoing variation in the higher level coding of perceptual and semiotic

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[4] For a review of the literature linking culture and perception see Anne D. Pick and Herbert L. Pick, "Culture and Perception," in Perceptual Ecology, Vol. X, Handbook of Perception, p. 19-36. Edited by Edward C. Caterrette and Morton P. Friedman. (New York: Academic Press, 1978); Jan B. Deregowski, "Cross Cultural Studies in Perception," in Harry C. Triandis, ed., Handbook of Cross-Cultural Psychology, IV (New York: Academic Press, 1980): 78-92.

For a sample of the writings on the link between culture and cognitive processes see J.W. Berry and P.R. Dasen, eds., Culture and Cognition: Readings in Cross Cultural Psychology (London: Methuen, 1974). See especially Mallory Wober's article on "Sensotypes." For a more detailed description of variations of cross-cultural sensitivity to perceptual illusions, see J.B. Deregowski, Illusions, Patterns, and Pictures: A Cross-Cultural Perspective (New York: Academic Press, 1980). For a critical evaluation of the research area and its methodological problems, consult M. Cole and S. Scribner. Culture and Thought. (New York: Wiley, 1974).

information which may caused by technological use and innovation.[5]

While it is only the individual who perceives, individual perception involves a subtle interaction with the larger socio-cultural systems. The primary vehicles for penetration of culture into the individual are the symbol systems of the society and the ideologies or worldviews they carry. We used the term symbol system in the broad sense given to it by general semiotics.[6] Semiotic systems and the individual signs within them are highly structured fields of relation. These relations or associations should not be seen as purely conceptual and static, but as complex cognitive processes involving the activation of propositional and emotive memory, gestural schema, and rules of semiotic production and response.

Perceptual change can be seen as an ongoing multi-level process. Listing these levels from the slowest and most stable to the fastest and most variable, we can identify the physical evolution of perceptual systems, cultural evolution, ontogenesis, on-going

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[5] For suggestive if not convincing evidence of intracultural generational differences in the use of internal sensory imagery when processing media fare see Mallory Wober, "Broadcast Media and Sensotypes," Independent Broadcasting Authority, Reference Paper, October 1983 (Mimeographed); Mallory Wober, "Sources of Sound and Delight: Patterns of Musical Taste and of Radio and Television Use," paper presented to the International Communication Association, San Francisco, CA, May 1984.

[6] For an excellent seminal work outlining the basis for general semiotics, see Umberto Eco, A Theory of Semiotics (Bloomington,IN: Indiana University Press, 1976).

adaptation, contextual variance.[7] Though it is important not to ignore the various levels and their interaction, this paper is primarily concerned with ongoing perceptual adaption brought on by technologically generated cultural change. This paper will argue that the new aural technologies of the telephone, phonograph, and radio dramatically altered the perceptual and contextual relations of cultural and environmental sound. This in turn led to higher level cognitive changes in perceptual schema for aural phenomena. While this reorganization most certainly cut across various social strata, this paper will concentrate on self-reports of perceptual change among those most sensitive to shifts in the aural environment, the avant-garde composers.

The theory that new communication technology can significantly

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[7] For an interesting if somewhat jargon filled attempt to bridge these levels with a theory of semiosis and perceptual variation, see Charles D. Laughlin and Christopher D. Stephens, "Symbolism, Canalization, and P-Structure," in M. LeCron Foster and S.H. Brandes, Symbol and Sense (New York: Academic Press, 1980).

For a classic work on the interaction of the environment and the physical structures of perceptions, see John J. Gibson, The Senses Considered as Perceptual Systems (Boston: Houghton Mifflin, 1966). The work on ontogenetic formation is vast. But for a work that approaches the question of individual development, culture, and ongoing perceptual change from a perspective similar to the one ascribed to here, see Paul Van Geert, The Developmentof Perception, Cognition, and Language (New York: Routledge,Keegan, and Paul, 1983). For a review linking perception, environment and ontogeny see David E. Clement, "Perceptual Structure and Selection," in Perceptual Processing, Vol. IX, Handbook of Perception, p. 49-84. Edited by Edward C. Caterrette and Morton P. Friedman. (New York: Academic Press, 1978)

alter the physical, perceptual, and semiotic environment has been well supported in historical work on the invention and diffusion of writing and printing. In the rise of this powerful visual communciation technology writers such as Eisenstein, Goody, Watt, Ong, and McLuhan have attempted to isolate and describe a number of important perceptual and social transformations. Non-literate oral cultures and their attendant psychological processes and world views were fundamentally and permanently altered by a significant shift in how information was disseminated, absorbed, and stored.[8]

Given the powerful influence of printing on mind and culture, what evidence can we find of any similar changes brought on by the arrival of three new aural technologies: the telephone, the phonograph, and radio? All three media arrived within one generation of Americans. Each one dramaticaly reorganized the flow of information. At the vortex of this whirlwind of change lay the ear and the psyche.

Historically one of most sensitive barometers of perceptual

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[8] These works vary in their analysis of the extent and nature of the socio-perceptual change. But all agree on its power and influence. See Jack Goody, Literacy in Traditional Societies (Cambridge: Cambridge University Press, 1977); Jack Goody, Domestication of the Savage Mind (Cambridge: Cambridge University Press, 1977); Walter Ong, Orality and Literacy: The Technologizing of the Word (London: Methuen, 1982); Elizabeth Eisenstein, The Printing Press as an Agent of Change and Cultural Transformation in Early Modern Europe (New York. Cambridge University Press, 1979). For the most circulated version of techno-sensory determinism, see Marshall McLuhan, The Gutenberg Galaxy: The Making of Typographic Man (New York: Signet, 1962); Marshall McLuhan, Understanding Media: The Extensions of Man (New York: Signet, 1964).

change has been the artist.[9] As the poet T.S. Eliot once wrote, "The artist smashes open the doors of perception." The link of the artist to new communication technology is historically interesting both at the level of artistic production as well as the level of artistic perception. The artist expresses cultural and perceptual change while at the same time acting as its catalyst.

Having placed technology, perception, and the artist within a single frame, a number of questions emerge readily from their association. Does the avant-garde composer begin to perceive sound through technology? Or to put it another way, with the arrival of the phonograph and radio does the avant-garde composer perceive sound itself as fundamentally altered in its new mediated and malleable form?

The phonograph more than the telephone initiated new relations between sound and man. Sound which for centuries had slipped away the moment it was created, was now frozen in time. Sound was now something one could hold, analyze, measure and

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[9] For a classic work on artists and perception, see Ernst H. Gombrich, Art and Illusion (New York: Pantheon, 1956). For a work linking a communication technology with artistic change see Walter Benjamin, "The Work of Art in the Age of Mechanical Reproduction," in Illuminations (New York: Harcourt Brace Janovich, 1968); Aaron Sharf, Art and Photography (London: Penquin, 1973).

disseminate in exact form.[10] The process of permeating the environment with a light air of music had begun with Edison's recording of his off key version of "Mary had a Little Lamb." In the spirit of communication identified with Harold Innis[11], the phonograph sliced sound into neat disks and carried them across time and distance. Just as they had used the camera to turn the world into a museum of the image; teams of anthropologists, linguists, court scientists, and musician-scholars spread through the globe fossilizing four minute fragments of obscure languages, animal sounds, aboriginal music, and the voices of great poets, scientists, and prime ministers.[12] The search was part of the classificatory spirit of the analytical eye now superimposed on the yet unordered world of unclassified sounds.

Among the many listeners-in to this exploration of sound was the avant garde composer. To the maker of sound, the composer, sound could also be studied. No longer would black marks on paper be the only manner to hold still a fleeting melody, now

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10 For early scientific uses of the phonograph to examine and measure speech sounds and languages see Fleming Jenkin and E.W. Ewing, "The Phonograph and Vowel Sounds," Nature (25 July 1878): 340-343, (8 August 1878): 395-398, and (22 August 1878): 455-458; Walter J. Fewkes, "On the Uses of the Phonograph in the Study of the Languages of American Indians," Science 15 (2 May 1890): 267.

11 Harold Innis, Empire and Communication (Oxford: Clarendon Press, 1950)

12 For a discussion of world wide efforts to record famous voices and sounds of the world, see A. Lillinston, "The Talking Machine," Living Age 254 (1907): 486-489; "Museums of Sound," Science 40 (21 August 1914): 273-4. For a report of the archival rediscovery of these "lost sounds" in the middle of the radio boom see "Archive of Voices," Living Age 318 (1923): 524-525.

sound itself could be captured. The link between music, sound, and technology became fused in the mind of the avant-garde. This fusion of sound and technology erupted into a proclamation when in 1906 the futurist composer, Frederico Busoni, called for a new "universal instrument" tuned to the new ear of the twentieth century. "Everywhere...symptoms of revolution appear in musical endeavors."[13]

The composer, as an artist, has for centuries been sensitive to developments in the acoustic technology. Each new instrument suggested new possibilities. But innovation was not always possible or welcome due to social, professional, or political constraints. But in the early decades of the twentieth century, an American citizenry still giddy over the Promethean accomplishments of the industrial revolution greeted innovation in the spirit of the new religion of "modernism."[14] One of the earliest, and most fantastic, experiments in electrical sound was the Telharmonium. This massive 100 ton behemoth of sound was demonstrated in New York in 1906 but lost without a trace during World

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[13] Ferruscio Busoni, The Essence of Music (New York: Dover Publications, 1957): 41.

[14] For a study of early modernist infatuation with technology, see Elting E. Morrison, Men, Machines, and Modern Times (Cambridge, Mass.: MIT Press, 1966). For the political and intellectual manifestations of that same spirit see William E. Akin, Technocracy and the American Dream: The TechnocraMovement, 1900-1941 (Berkeley: University of California, 1977).

War I.[15] It was news of this electrical instrument which prompted the Italian composer, Busoni, to issue his futurist manifesto calling for a merging of music and the new technology. But it was not until the decade of radio, the 20s, that this desire for a welding of aural technology and music ignites a creative spark. The Thermin, the Spherophone, the Dynaphone, the Ondes Maternot, the Trautonium, and the Staccatone were all created in a fevered decade of invention. The Staccatone was presented as a direct offspring of radio, a sweet voiced child that turned the demonic squeals and hiss of the ether into "a musical instrument that surpasses in range any musical instrument..." Many of these new instruments were featured in the works of major composers with use of the Trautonium continuing into the late 1950s.[16]

Turning with new awareness to the aural technology, the composers in the 1920s sought to transform the phonograph into a musical instrument. Varese, Hindemuth, and Milhaud explored its musical possibilities by altering its speed, playing sound backwards, and altering the grooves of the discs in a search for

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15 For early reports of the new instrument see, "The Art of Teleharmony," Electrical World 47 (1906): 509; and R.S. Baker, "New Music for an Old World," McClure's Magazine 27 (1906): 291.

16 For an early article on the Staccatone see "Radio Music," Literary Digest (12 April 1924) : 26.

For a description of the trautonium in relation to radio see R. Raven-Hart, "Radio and A New Theory of Tone Quality", The Musical Quarterly, 17 (October 1931): 382 ff.

new effects.17 The phonograph had turned sound into matter. That very act transformed the concept of sound itself. These manipulations of sound on the phonograph had been unimaginable 100 years earlier. In only a few years they were to become mere child's play. The musical intertwining of the composer and the new aural technology would become a dominant note of the avant garde artist.[18]

In the 19th century, Octave Uzanne had noticed an opening in the black and white wall of print culture. The phonograph could be heard faintly through that opening. But radio was to beam through the wall of print. New dimensions of aural experience were disseminated to an expanding circle of American homes. Sound filtered through the radio and into the psyche of the new "listening public."

In 1922 America was startled by the blare of the new medium. The nation was gripped by a craze over the new

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17 Jean-Claude Risset, "Musical Acoustics" in Edward C. Carterette and Morton P. Freidman, Handbook of Perception, vol. 4, Hearing (New York: Academic Press, 1978) : 549. See also, Henry Russcol, The Liberation of Sound: An Introduction to Electronic Music (Englewood Cliffs, N.J.: Prentice Hall, 1972).

18 The link between new technology and avant-garde composition has become a permanent feature of advanced art music. The symbiosis would again flare up with the dissemination of audio tape in the late forties and fifties. For a representative discussion of the link between the composer and technologies including computers, consult the proceedings of a 1970 UNESCO conference, UNESCO, Music and Technology (Paris: UNESCO-La Revue Musicale, 1971). For a discussion linking technological change in various media with more modern changes in popular music, see James C. Curtis, "Toward a Socio-technological Interpretation of Popular Music," Technology and Culture 25 (January 1984): 90-102.

"music box." Full page banner headlines screamed "RADIO CONCERTS START."[19] Reports came in from all over the country that the nation was "radio-mad" and in a "fever heat." Journalists described a "purchasing craze," "a veritable epidemic," "bombs bursting in the air."[20] According to the most conservative estimates, the number of radios by late 1923 jumped by an astounding 660% though a number of contemporary writers placed that estimate as high as 2500%. The number of stations increased by 1850% in 1923 alone.[21] In a decade when Henry Ford was the nation's role model, a writer from a bastion of print culture, the magazine The Bookman, chastized the new medium for being a "sound factory."[22] One of the first presidents of NBC, swept up by the tidal wave of

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19 Joseph Pusateri, Enterprise in Radio (Washington: University Press of America, 1980): 26.

20 "Is Radio a Passing Fad?," Literary Digest 73 (3 June 1922): 31; Radio Broadcast (May 1922): 157; "Radio in the Musical Home," Etude (September 1927): 256; Pusateri, op. cit.: 27; Gleason L. Archer, History of the Radio 1926 (New York: American Historical Society, 1932): 252 ff.

21 U.S. Dept of Commerce, Bureau of Census, Historical Statistics of the United States, Vol. 2 (1975): 796.

For contemporary estimates and information on the social distribution of radios see Herman Hettinger, A Decade of Radio Advertising (Chicago: University of Chicago Press, 1933). For a contemporary analysis of the growth of radio relative to other media see, Ernest W. Burgess, "Communication," American Journal of Sociology 34 (July 1928): 117-129; Ernest W. Burgess, "Communication," American Journal of Sociology 35 (May 1930): 991-1001.

22 Robert A. Simon, "Giving Music the Air," The Bookman 64 (1926): 596-599.

interest, gushed, "Nothing has ever moved with the same speed...radio came into its own almost overnight."[23]

Within a few years came reports of a dramatic rise in "musical awareness."[24] A headline in Radio Broadcast asked, "Is America becoming more Musical?" The Musician, forever sensitive to the changing environment, announced an aural awakening, the "nation...is becoming more and more tone minded." For some musicians it seemed like the dawning of a new age. Headlines in music and broadcast publications told the story: "America Musically Now Comes of Age," "This is the Golden Age of Music in the United States," "Radio is Doing a Good Job in Music."[25]

By the middle of the decade the New York Times was reporting a boom in the sale of musical instruments. The instrument manufacturers tipped their hat to the new aural medium. With

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[23] M.H. Aylesworth, "Radio's Accomplishment," Century Magazine 118 (June 1929): 221.

[24] For a study on systematic efforts to raise this "musical awareness" via radio and an ensuing disappointment following the rise of jazz see, Frank Biocca, "Communication Technology and Perceptual Shifts: Radio and the 'Rediscovery' of Music," paper presented to the joint meeting of the Popular Culture Association and the American Culture Association in Louisville, KY, April 1985.

[25] "Is America Becoming More Musical?" Radio Broadcast (May 1926): 25; "The Studio Doors are Again Flung Wide," The Musician 33 (October 1928): 9; Margaret Anderton, "America Musically Now Comes of Age," The Musican (November 1928): 29; Oscar Saenger, "This is the Golden Age of Music in the United States" The Musician (July 1928): 10; John Wallace, "Radio is Doing a Good Job in Music, " Radio Broadcast (August 1927): 218-219.

apparent gratitude, the slogan at their 1925 Silver Jubilee was "Radio is Doing Much to Make America Musical."[26]

If the perceptual sensibilities of the American public were shaken by the whirlwind of aural technology, then the exposed nerves of the artist must have been raw from the gusts of sound that were circling the globe. At the turn of the century, it was clear thac the phonograph was already changing the way composers experienced and thought about music. On the year of the birth of mass radio, avant-garde composers most enthused by the new technology banded together to form the International Society for Contemporary Music. Their manifesto proclaimed, "Mourir est le privi ege de ceux qui sont epuises. Les compositors d'aujourd'hui refusent de mourir."[27]

The composer could only flourish in a period when a historically unprecedented audience of millions had daily access to a cornucopia of the world's music. In this world of beamed sound, art music was transforming itself dramatically. Aural technologies like radio were preparing a soil rich with a perceptually altered public. Composers themselves were part of this public. In the flood of aural experience that the new

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[26] "Music Trades Silver Jubilee To Feature Radio Apparatus," New York Times 7 June 1925, sec. XX, p.16.

[27] "Death is the priviledge of those who are exhausted. The composers of today refuse to die."

Georges Charbonnier and Harry Halbriech, Entretiens avec Edgard Varese (Paris: Pierre Belford, 1970), : 99.

technology allowed, their creativity was invigorated. The phonograph and radio participated in the process of musical change by preparing the audience, musicians, and composers for new forms of aural experience, by shifting the sensory ratio in favor of greater cognitive attention to hearing, and also by diffusing the new experiments in sound.

Since the turn of the century, a radical and anarchistic expansion of the meaning of music was underway. The world of the composer had not been rocked in this way since the arrival of le nuove musiche in the 17th century. Moving beyond the expressionistic phrasings of Debussy and Ravel, the early 20th century saw the arrival of new tone scales and acoustic experiments from composer theoreticians like Schoenberg. New methods such as "total serialism" echoed the mechanisms of an industrial society and the rumbling of its technological engine. The most avant-garde artists were fused to the new technology. This technology became a fundamental part of musical experience and expression. Composers such as Shoenberg, Busoni, Varese, Stravinsky, Chavez, and Stokowski applauded the young prodigies of the industrial revolution.

> The radio...[is] the social institution of our day controlling the whole musical movement...The whole structure of musical activity will undergo a gigantic transformation because of the radio. We must reach a point from which we can get the whole perspective.28

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28 Carlos Chavez, Toward a New Music: Music and Electricity (New York: W.W. Norton & Company, Inc., 1937): 137; for an extended discussion of this Spanish composer's personal fascination with aspects of the medium see pp. 122 ff.

To a number of these avant-garde composers the experience and unexplored possibilities of radio clearly fascinated them.

But even though some of the most reknown composers saw in the radio endless possibilities, others, perhaps more timid or conservative, perceived only limitations. For these composers the new medium was not to be measured by new possibilities but by the yardstick of fidelity to the concert hall. If the exact replication of the concert hall experience was the hallmark of musical experience, then radio surely would be condemned as inadequate. It was purely an aural medium and the concert hall was as much a visual experience as an aural one. Very early on, the state of the microphone had required special radio rescoring of many compositions from the traditional classical repetoire. In its early stages, the medium trimmed off the high and low frequencies of the register. The piano seemed flat and certain instruments such as the double bass caused horrendous distortion. On the other hand, the medium was "particularly kind" to the saxophone and the clarinet.[29] These instruments, not surprisingly, increased in popularity. Most of these engineering problems would eventually disappear with technological development.

But many composers were not interested in writing around the microphone as for the microphone. "Radio is an entirely new medium,...a new form," wrote the composer, Davidison Taylor. The technology had become part of the process, "With radio, the microphone itself almost becomes an instrument." To the Spanish

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[29] R. Raven-Hart, "Composing for Radio," The Musical Quarterly (October, 1930):133-37.

composer Carlos Chavez, the change was irrevocable, "The old principles of instrumentation have broken down. No composer can consider himself informed if he does not know the microphone." To the American composer Roy Harris, representative of a new breed, the rising aural technology was the new instrument, "I am interested in writing for the microphone, because I am convinced that that [sic] way lies the future of music". Some of these composers began to speak of a new "aural magic" and tried to convince their colleagues, the writers, "to learn writing for the ear alone." In the new medium all aural phenomena achieved a certain equality as pure, unattached, and unencumbered sound. The spoken word itself seemed to be emerging from the long shadow of its printed twin, "The power of the spoken word has never been so great."[30]

To the composer's sensibilities, the socio-psychological experience of the aural media expanded and enhanced the sensitivity of the ear; it was a new form of hearing. The aural media brought about a "musicalization of sound" itself. For the new artist, radio suddenly turned up the volume on the world. Rudolf Arnheim, by far the most sensitive and profound media theorist of his day, reported on the transformation in an insightful work on the new medium. In the late twenties, he had already noted radio's aural agenda:

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[30] Eric Von Haden, "The Orchestra and the Radio" (MA Thesis, University of Wisconsin, 1936): 18,37; Davidson Taylor, "Tommorow's Broadcast" North American Review 241 (January 1936): 49-56.

> But what is more important for broadcasting in the development of music is that the extension of its expressive character, whether it was a good thing for music itself or not, provides a good basis for a general art of sound, by developing our feelings for the musical elements of speech and sounds.31
>
> The discovery of the musical note in sound and speech, the welding of music, sound and speech into a single material, is one of the greatest artistic tasks of the wireless.32

By the time radio composers from all over the world gathered in 1929 in Baden Baden for the first International Conference on Radio Music, the art o composing for the new aural technology was already taking hold.[33] A number of pieces including Shoenberg's "Pierrot Lunaire," and Honneger's "King David," had taken new life and form when played through the radio. Few in 1929 had understood how to use the medium as well as the German composer, Paul Hindemuth. Hindemuth incorporated the strengths of radio into the creative logic of his innovative "Lindbergh's Flight."

Rudolf Arnheim summed up the exhileration of these early years of experimentation:

> Broadcasting has constituted a new experience for the artist, his audience, and the theoretician: for the first time it makes use of the aural only, without the almost invariable accompaniment of the visual which we find in nature as well as in art. The results of even the first few years' experiments with this new form of expression can only be called sensational. An alluring, exciting world has been

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31 Rudolf Arnheim, Radio (London: Faber & Faber, 1936): 42-43.

32 Ibid., p. 30-31.

33 R. Raven-Hart, "Composing for Radio," The Musical Quarterly 16 (October 1930): 133-137.

> revealed continuing not only the most potent sensuous delights known to man -- those of musical sounds, rhythm and harmony -- but capable also of reproducing actuality by transmitting real sounds...34

As radio progressed, composers observed that the aural medium was "consuming" material far too rapidly, the "search for 'new' effects" was becoming a burden for some, and that orchestrations would become increasingly complex.[35] But nonetheless, it was clear that a variety of sounds were being "musicalized" and the range of musical expression was being extended.

For many avant-garde composers, the "musicalization of sound" was only part of the agenda. Like the popularizers of the "classics," they realized that radio was propagating a new musical awareness. But unlike the former, the avant-garde understood that a perceptual shift was underway. Through the new medium, they hoped to further change the world of sound.

One of these composers was Leopold Stokowski.[36] As conductor of the Philadelphia Orchestra, Stokowski had been the first to initiate the medium to a series of regular classical music broadcasts. Like many of the leading composers of his day including Varese, Shoenberg, and Stravinsky, he participated and initiated research at Bell Telephone Labs. The research center born of an aural technology was by far the world center of basic research into hearing, sound, acoustics, and electrical

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34 Arnheim, op. cit., p. 14f.

35 Von Haden, op. cit, p. 40f, 15-16.

36 Paul Robinson, Stokowski (New York: Vanguard Press, 1977)

engineering.[37] Stokowski realized a fundamental change was occurring, "The whole sphere of sound has become vastly freer. Those that know this to be true and realize the scientific basis for it become much more open minded..."[38]

Sensing that the social perception of sound had changed, Stokowski believed that the meaning of "natural sound" had somehow died. "What, then is the natural sound of an orchestra?"[39] The pursuit of "natural sound" was a shibboleth of an older age of music. In deference to the "mechanical nature" of the new media, Stokowski emphasized the technological aritifice of the traditional instrument. The change was wrought not by the mere "artifice" of the new instruments of sound, but by the new "ear" that resulted from altered perceptions of sound and of tone. As an artist, Stokowski had sensed the change in himself. This changing relation to sound, which had descended like thunder on visual society through the agency of aural media, was for Stokowski quite clearly a socially diffused "extension" of perceptual "consciousness."

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[37] To see just how fundamental this research was, consult the classic text in hearing and speech written by the director of research and close personal friend of a number of leading figures in music, Harvey Fletcher, Speech and Hearing (New York: Van Nostrand Co., 1929). This text would not be surpassed for another 24 years and then only by an updated version written by Fletcher himself.

[38] Stokowski, op. cit., p. 9.

[39] Ibid.

> With the new possibilities of sound being opened up today...I suspect that there is no longer any unchangeable norm in our minds of good tone and tonal relation. Through constant experience of listening by radio and laboratory experimentation with electrically produced and reproduced sound and wired transmission of music, our horizons have become so vastly extended that formerly accepted standards and definitions of 'good' and 'bad' and 'natural' and 'artificial' tone have become less dogmatic and more fluid. Or it might be better to say that they are no longer adequate but give a limited and incomplete view of a field which is every year becoming more extended in our consciousness.40

Stokowski felt that the time had come to expand the world of music and to stretch to the very limit of the range and plasticity of the human ear. To that end, he had become a strong advocate, along with some support from Bell Labs, of a national system of "wired transmission" (cable radio). This, he felt, could initiate leaps in sound quality and musical range while making stereo an immediate possibility.[41]

Because the ear was directly connected "in some mysterious way" to "emotion, mood, and states of being," the very pervasiveness of the medium offered new utopian possibilities. With appropriate imagery, Stokowski used a metaphor to describe a process in which technology is the source to some "heightening" of awareness and sensitivity.

> When in India, I used to look at Everest and Kinchingjunga in the Himalayas, and it seemed impossible to me that man could ever climb to the highest of these masses. Now the airplane

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40 Ibid.

41 In the commercial form familiar to us, stereo does not arrive until 1954, though numerous special performances and experiments are recorded all the way back to the 1880s and "stereo telephone" relays of Parisian stage performances.

> has flown up to them and higher still... Wired transmission is the airplane which, in the control of those who know how to use it, could lift millions of listeners to higher peaks of musical experience.42

Both images deal with a kind of physical transcendence, a collapse of space, and the transportation of oneself across vast distances. In it we can feel some of the emotional uplift and sensation of distant travel expressed by a number of performers in this decade when playing live to a vast geographically diffuse audience, the size of which had been heretofore unimaginable.[43]

Some of these musicians and composers began to see aspects of their world through the technology. In this they resembled the Roman architectural genius, Vitruvius, who imagined a massive celestial harp jutting up from the south pole, stretching chords to all points north on a flat world. And in some celestial order purely visible to the inner eye of Vitruvius, he had an explanation through his analogy for why the voices of distant peoples seemed to grow deeper in tone as one voyaged along the longer strings of this harp stretching to the north. Vitruvius, in a fantastic, but by Roman terms, exquisitely logical and mathematical way, had perceived his aural environment through the

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42 Stokowski, op. cit., p. 10.

43 For two good examples of this see Gordon B. Nevin, "Making Music for An Invisible Audience," The Musician (April 1922): 2,30; A. Duthernoy, "Singing to Tens of Thousands: Impressions of an Artist During His First Radio Concert," Radio Broadcast 2 (November 1922): 49-51.

aural technology of his day.[44]

In a similar way, Stokowski saw the possibility of social transformation through the diffusion of the emotional power of radio. He shared the vision of social uplift with other members of the music elite. But while most of this elite merely imagined a kind of sitting room rise in "appreciation," Stokowski's vision was far less mundane. Like many other futurists of the period, he percieved the possibility of a utopia of universal communication whereby a union is achieved as thought passes from "one mind to endless other minds."[45]

For Stokowski this was not all visionary idealism. The agenda for an aural awakening was already under way. But Stokowski had attached emotional and political significance to the transformation. And in his vision the radio metamorphosed into a garden maze full of pleasureful niches recalling the vivid phantasms of Hiermonyous Bosch:

> I have a picture in my mind of great recreation centers where we might go in our leisure hours and find opportunity for freedom and relaxation...In one part of the gardens might be a high tower from which bright colored light would create a new art of color in motion and form. From this tower music of several kinds might be sent out over a large part of the gardens. Sometimes good jazz for dancing, both open-air and under-cover; about three times a week the finest symphony concerts; at other times singers, violinists, pianists of the highest order...The tower would be so high and the loudness so adjusted, that thousands could hear it in the

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[44] Vitruvius (Pollio), Ten Books on Architecture, VI (New York: Dover, 1960).

[45] Stokowski, op. cit., p. 15.

gardens...The music would be clear, full, and unobtrusive.[46]

In this transmogrified image one can see the outlines of more familar forms; the tower was radio incarnate, the garden, America. But it is in the mirror image of Stokowski's utopian vision of radio that we perceive an anti-utopian counterpart. Stowkowski feared that the latter might usurp the future. In this scenario, radio would not transform but permeate the psyche with a "background of noise."[47] The social engineering use of music for emotional and psychological uplift in work, play, and, especially, the consumerist play of shopping, was already under way in the early innocuous forms of "musak."[48] The electrified ear was to provide a tiny passageway to the inner chambers of the mind.

This rise of aural technology and the perceptual shift that it engendered parallels a change in the artistic ethos of the modern music master. Prior to the twentieth century, the composer was part of an artistic culture which has been labelled "the cult of genius." The 18th and 19th century composer searched with scribbling nib for an inner, spiritual music in an ordered noumenal universe of Platonic perfection. Music was related to

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[46] Ibid.

[47] See Ibid., pp. 13 ff.

[48] For reports of early psychological uses of music in the work place and elsewhere see "Sorting Mail to Music," Literary Digest (4 March 192[illegible]:22-23; "Music to Aid Factory Workers," Literary Digest (4 December 1926):24; Ernest W. Burgess, "Communication," American Journal of Sociology 35 (May 1930): 991-1001.

mathematics. This dogma had become a recurrent philosophical chorus ever since the Greeks sought to harmonize the cosmos.

In the twentieth century, the composer stepped down from the noumenal realm and embraced the world of acoustic phenomena. With aural technology, the artist experienced a cognitive heightening or refocusing of the sense of hearing. The electronic ear became an exposed nerve. Within this heightened sentience, the composer ceased to be a translator of spiritual essences plucked from some noumenal ether. The search for sound was liberated from this solipsistic spirituality, the straightjacket of mathematical elegance. The modern composer fell on his knees with ear to the ground, gripped with an aching visceral need to hear new sounds. Mathematical elegance was crashed with the grating metal of new disharmonies.[49] The rising ethos of music as "found sound" is exemplified by the "self-interrogation" of composer, Albert Richard.

> Interrogator: But aren't you an individual, a musician?
>
> Musician: No!
>
> Interrogator: Nevertheless you're a man, and you write music; other men read it and perform it; therefore you're a musician, no?
>
> Musician: Once again, no! Man cannot create; his only capabilities are those of recognizing or becoming aware of

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[49] For a work emphasizing the role of musical disharmonies as part of a program of liberation from the confines of inherited order, see Theodor Adorno, The Philosophy of Music (New York: Seabury Press, 1973).

things.

Interrogator: But nevertheless, your music, you do in fact write it?

Musician: No, once again no! I simply note what I hear, that's to say, whatever makes itself known to me...50

In an early book on radio music, the composer Percy Grainger clearly points to the technological amplification and extension of the global envelop of sound.

None of us quite escape science, which has, paradoxically brought us to listen to the sounds of nature... Therefore, to me, outstanding features of the music of the future...will be greater use of irregular rhythms, greater freedom of form, irregular measure formations, smaller intervals, gliding melodies, fewer harmonies (consonants), and more discords (dissonants.)51

Leopold Stokowski saw the beginning of a creative social cycle whereby "discovery" or inspiration was followed by transmission, reception, and then back to inspiration. Through this he was pointing to a circle of creation and expression whereby the media were new interlocutors. Radio was to be both the goal and the goad to creation.

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50 Albert Richard, "Interrogatory of a Musician", UNESCO, op. cit., p. 34f.

51 Percy Grainger, "As the Composer's See It: Modern Trends in Music," in Hazel G. Kinscella, Music in the Air, (New York: Viking Press, 1934): 235.

In the breadth of Stokowski's agenda for a new wired universe of sound, we can see a revolutionary desire to expand the boundaries of perception to new limits. It was this passion, which led him to leave his post as conductor of a prestigious orchestra to work in Bell Laboratories. Another influential figure in the history of music, who also at one point associates himself with Bell Laboratories, is the French composer, Edgar Varese.

A friend of avant-garde novelist-playwright-director, Jean Cocteau, and Dadaist painter, Marcel Duchamp, Varese was at home moving on the outer circles of twentieth century art. An acquaintance of Debussy, he bridged the transition from impressionistic compositions to the more atonal and systematic works that would come later. As cofounder and key figure in the International Composers Guild, he organized performances of modern pieces by Schoneberg, Stravinsky, Berg, Webern and many others. Most of his major works were produced during the decade of the rise of radio, the 1920's.[51] The first performance of his Hyperprism in 1928 caused violent outbursts from an audience whose sensibilities could only be stretched so far. This came after the critical acclaim of his piece Amerigues, performed by

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[51] Compositions during this period include Offrandes, 1921; Amerique 1926 (mostly completed in 1921); Hyperprism, 1923; Integrales, 1924-25; Arcana, 1925-27; Ionisation, 1929-31.

For a description of the origins of the works and a critical evaluation see Georges Charbonier, Entretiens Avec Edgard Varese (Paris: Pierre Belfond, 1970); Hilda Jolivet, Varese (Paris: Hachette Literature, 1971).

Stokowski and the Philadelphia Symphony Orchestra. In Amerigues he had etherealized the sounds of the new nation.

Varese was keenly aware that music was being extended and expanded. This was for him part of a general "acoustic" phenomena, a rising social awareness:

> Georges Charbonnier: Quand et comment vos idées sur l'organisation et la projection des sons sont-elles nées?
>
> Edgar Varese: Il y a plusiers années, un phénomène acoustique auquel j'assistais, et que je décrirai, fût pour moi la matérialization physique de l'organisation des sons et de leur projection telle que je l'avais mentalment imaginée pendant de longues années...52

Varese continues to relate a story about feeling the distortion of sound while listening to a concert. He describes a distinctly modern conception of sound as "rays of sound," as if emitted by a "projector in the sky." Varese articulated the same feeling that a number of artists expressed upon performing on radio, the sensation of travel. "Pour l'oreille, comme pour l'oeil, ce phenomene donne un sentiment de prolongation, de voyage dans

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52 "Georges Charbonnier: When and how were your ideas regarding the organization and projection of sound born?

Edgar Varese: A number of years ago there was an acoustic phenomena, in which I assisted, and was for me the physical materialization of the organization of sounds and their projection of which I had dreamed (imaginee) for a number of years..."

Charbonnier, op. cite., p. 74.

l'espace."[53]

Varese was fascinated with the fundamental questions of sound, "J'ai toujours été intéresse par les problemes du son."[54] For this reason he refused to refer to his compositions as music, preferring to call them "organized sound." The very phrase summarized the new artistic ethos that was emerging and which would find its greatest expression in musique concrete.

Desirous to extend sound everywhere like radio itself, Varese in 1933 attempted to gain the support of Bell Laboratories and the Guggenheim Foundation for research into new electrical instruments.[55] It would also be headed by the premiere scientist of sound and hearing, Dr. Harvey Fletcher. This laboratory was to start with the products of an earlier aural technology, the phonograph, and gather recorded sounds from "all races, all cultures, all periods, and all tendencies." Like Busoni, Varese had felt that new instruments were necessary to stretch the boundaries of sound. His was an "art-science" imbedded in existing and yet uncreated aural technologies. When he had a

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[53] "For the ear, like the eye, the phenomenon gives one the sense of physical extension (prolongation), of voyage in space."

Ibid.

[54] "I've always been interested in the questions of sound."

Ibid, p. 85.

[55] Fernand Ouellette, Edgard Varese (Paris: Seghers, 1966): 113f.

chance to talk to Albert Einstein about the new music, he was met with disappointment. The paradigm of new thought and of the new century did not want to leave the eighteenth century. Einstein only wanted to talk to Varese about Mozart. His attempt to create the new research center for aural technologies similarly met with disappointment.

But there was one "musical instrument" that already existed. Infinitely maleable, it was a paradigm of the new world of sound. Ever since its introduction, radio had created some confusion as to whether or not it should be considered a "musical instrument." After all, like the instruments before it, radio did produce music. And in a way, it was played. At the State Convention of Music Dealers of Illinois in 1922, the question had been hotly debated for days. How would they classify the "new musical instrument?"[56]

In the most ambitious version of an unfinished work on which Varese had toiled for 11 years a "new instrument" would occupy center stage. With him, for a while, Andre Malraux also worked to bring the sounds to life. In L'Espace the new aural medium would find unity with music. In the composer's world of "organized sound," a key organizer would do its work. In Varese's white hot vision, the score of "L'Espace" would be played and broadcast simultaneously on radio stations around the globe. Herein lay Varese's vision of truly "projected sound." L'Espace would be a

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[56] "The Radio Set A Musical Instrument," Radio Broadcast (January 1923).

paean to the medium and the aural revolution which it spread; Varese would be the coryphaeus. In an orgasmic universal burst of sound, radio itself would emerge as the musical instrument.

> Le thème: AUJOURD'HUI. Que le monde s'éveillé...Le pietinement de millions de pas qui résonnent, sourdement, inlassablement, staccato, trainant, piétinement sourd. Allez crescendo final donnant l'impression que l'impitoyable marche en avant s'arrêtera jamais (...) se projetant dans l'espace... Des phrases, des slogans, des voix dans le ciel, comme si des main magiques et invisibles tournaient les boutons de postes de radio fantastiques, des voix emplissant tout l'espace, se croisant, se chevauchant, s'interpénétrant, se brisant, se repoussant, s'écrasent, se broyant les unes contres les autres...la Chine, la Russie, l'Espagne, les États fasciste, et les Democraties...57

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The Theme: TODAY. Let the world awaken...The sound of millions of footsteps resonating, deafening, unremitting, a staccato of dragging thunderous feet. Then a final crescendo giving the impression of a pitiless, endless march forward...projecting itself into space...Phrases, slogans, voices in the sky as if magic, invisible hands were turning the control dials of unearthly radio stations, voices filling all of space, crossing each other's paths, interlocking, interpenetrating, then splitting apart, appearing then vanishing, then crashing into each other...in China, Russia, Spain, the fascist states, the democracies...

Varese quoted in Ouellette, op. cit., p. 143.