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**LA THÈSE A ÉTÉ  
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**Technological Rationalization and Musical Practice**

**Paul David Théberge**

A Thesis  
in  
The Department  
of  
Communication Studies

Presented in Partial Fulfillment of the Requirements  
for the Degree of Master of Arts at  
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## ABSTRACT

### Technological Rationalization and Musical Practice

Paul David Théberge

In his book, The Rational and Social Foundations of Music, the sociologist Max Weber analyzed the development of Western musical materials --its tonal intervals, scales and harmonic system, its methods of notation, and its musical instruments--and revealed the degree to which these materials had become progressively subject to rational calculation. Implicit in Weber's argument is the link between the "rationalization" of music and that of the Western social and economic system as a whole. In the thesis, Weber's work is the point of departure for a study of twentieth-century music and technology. Two specific moments are singled out for detailed analysis and interpretation: the development of avant-garde electronic music during the post-War years and the rise of multitrack recording in popular music during the 1960s. In addition to Weber's concept, the "Frankfurt School" critique of modern science, and technology and the notion of the "domination of nature" is also applied. In this way, recent uses of technology in music are linked to the philosophical foundations of modern science and to the more general uses of technology in society.

## TABLE OF CONTENTS

Introduction		1
Chapter One	The Theoretical Framework	7
Chapter Two	Weber and Adorno: Rationalization and Domination in Music	37
Chapter Three	Science, Technology, and the Post-War Avant-Garde	77
Chapter Four	Technology and Popular Music	118
Conclusion		162
References		173

## INTRODUCTION

So it is that Western music at the outset marks itself off from the culture as a whole, reconstitutes itself as a self-contained and autonomous sphere...Not only does music thereby acquire an internal history of its own, but it also begins to duplicate on a smaller scale all the structures and levels of the social and economic macrocosm itself....

In it, for instance...we find a tiny history of inventions and machines, what might be called the engineering dimension of musical history: that of the instruments themselves, which stand in the same ambiguous relationship of cause and effect to the development of the works and forms as do their technological equivalents (the steam engine) in the world of history at large (the industrial revolution). (Jameson, 1971: 14)

A social or cultural approach to the study of music must at all times confront the fact that the ultimate object of its investigation--the music itself--defies simple description, enshrouds itself within specialized and technical vocabularies, abstruse aesthetic theories, and formal justifications based on unassailable "natural" laws. It resists interpretive approaches by virtue of the abstract compositional logics that govern its internal operations and obscures possible social determinations by the apparent coherence of its relatively autonomous historical development. To shift one's focus of attention to changes in musical technology however may offer some assistance in the development of such an approach because firstly, the development and use of a new technology can be regarded as a kind of nodal point where the musical, the social, and the economic intersect in a variety of concrete ways; secondly, the

accommodations in musical practice that accompany the introduction of new technology reveal much about the very nature of that practice and its relationship to social/cultural practice at large; and thirdly, the technical, theoretical and aesthetic discourses that are created in order to explain, justify or promote the use of new technology are ideological in character and related as such to a more general set of ideologies manifest in society. This latter point can be illustrated through a glance at the following statements:

I fight for the liberation of sound and for my right to make music with any and all sounds.  
(Varèse, 1967: 201)

This will be indispensable to those composers who are not content to accept sound phenomena as given facts, but who, in opposition to the dictatorship of the material, attempt to drive their own formal conceptions as far as possible into the music. (Stockhausen, 1961: 60)

one of the prime attributes of the [multitrack] studio is that it liberates performance. (Cutler, 1985b: 29)

A huge advantage of separation recording is control—the freedom to adjust the level of each track...the freedom to equalize...the freedom to alter...(Everest, 1975: 20)

Only in coming to electronic music can one talk of real musical control of Nature. (Eimert, 1958: 20)

There is a sense in which some larger political and social background makes itself felt here within the smaller history of music. It is perhaps evident in the way that these statements utilize the concepts and rhetoric of that larger world of events with such apparent ease. But what is one to make of these contradictory claims for the "liberation" or "control" of musical material? How was it that sound, or performance, had come to require "liberation" in the first place? What could it pos-

sibly mean to liberate sound? And what is the relationship between freedom and control in music? The pertinence of these questions may not, at first glance, be entirely obvious. But underlying the statements quoted above is the assumption that the desired ends (liberation, control, etc.) will be accomplished through technical means.

The study proposed here will examine the role of technology in contemporary musical practice (both that of the avant-garde and popular culture) within a framework that attempts to balance musical, technical, and social/theoretical perspectives. By "musical practice" I mean music as it is composed, performed and recorded. To create a distinction in this way between the makers and consumers of music is perhaps somewhat artificial, especially today, when technology is contributing to the breakdown of such distinctions. Indeed, the discussions of music that will be presented here will, on occasion, come up against this artificial barrier. Nevertheless the scope and purpose of this study requires that such a distinction be maintained.

The specific periods that I will focus detailed study on are the 1950s, when tape recording and electronic tone generation were first introduced into the musical practice of the post-War avant-garde; and the 1960s, when multitrack studio recording developed in popular music. There are perhaps two reasons why I have chosen these periods. The first is that while sound recording during the early part of the twentieth century had fundamentally reorganized the economic and cultural patterns of musical distribution and consumption, the actual making of music--the practice of singing and playing instruments--had, with some exceptions, not undergone such radical changes. But with the introduction of the tape recorder after World War II, music-making came to be



much more fully integrated with electronic recording technology as a means of production. It is this phenomenon, and the background leading up to it, that is of most immediate interest to this study. Secondly, various aspects of the technologies, theories and practices that evolved during these periods have recently begun to appear in other guises (e.g. in computer programs; some of these newer technologies will be discussed briefly in the main conclusion to the thesis). For this reason, a re-assessment of these earlier periods of technological development would seem to be appropriate at this time.

In order to make the links between these particular technological developments in music and those in society at large, I will interpret these events through two main theoretical perspectives: that of "rationalization," introduced by the sociologist Max Weber and applied to the study of music by him in a short work entitled, The Rational and Social Foundations of Music (1958c); and that of the "domination of nature," a philosophical foundation of modern science that became the basis of a critique of science and technology made by the "Frankfurt School" and more recently developed by William Leiss in his book, The Domination of Nature (1972). The work of Weber, in particular, will serve as a model for the study at hand.

The themes of rationalization and domination figure prominently throughout this study. Chapter One will be devoted to a summary of some of the main features of these conceptual categories. This will be done in considerable detail and not all the ideas presented in this chapter will be followed up with equal emphasis in later chapters of the thesis. My aim here is to give as full an account as possible of these complex

ideas. At the end of the chapter, I will also propose a subsidiary theme—that of "simulation"—that will be developed further in Chapter Four.

Chapter Two attempts to apply the conceptual framework to a rather broad historical account of various aspects of Western music: notation, melody and harmony, instrumental tuning, etc. The chapter is divided into two parts: one dealing with Western art music with special emphasis on the compositional method of the early modernist composer Arnold Schoenberg; and the other dealing with early twentieth-century jazz and Tin Pan Alley popular music. The work of Theodor Adorno is discussed throughout this chapter and a number of issues are raised that are of considerable importance to the arguments presented in subsequent chapters of the thesis.

Chapter Three presents a series of arguments concerning the rise of a scientific attitude towards music that developed in art music during the early twentieth century. This attitude culminated in the post-War years with the establishment of "musique concrète" in France and "elektronische musik" in Germany. The bulk of this chapter is devoted to an analysis of the theoretical foundations and technical practices of these two "schools."

Chapter Four deals with the rise of multitrack recording in popular music during the 1960s. Given that popular music is considerably less laden with theoretical positions than avant-garde music, the analysis here is more technical than the previous chapter and, perhaps, even a bit impressionistic at times. The study focuses on the studio as a production environment: as a particular organization of time, space,

technology and labor. Questions related to the ideology of studio practices are also raised.

Apart from summarizing some of the main themes and their significance for the thesis as a whole, the final Conclusion also briefly looks at a number of more recent technologies with regard to their relationship to the technologies and practices discussed in Chapters Three and Four.

It is hoped that this thesis will contribute in some small way to that "tiny history of inventions and machines" that belongs to music and, in the process, perhaps shed some light on issues that are relevant to the study of technology and its role in society at large.

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CHAPTER ONE  
THE THEORETICAL FRAMEWORK

In his introduction to The Protestant Ethic and the Spirit of Capitalism (Weber, 1958b: 13-31), Max Weber outlined a number of social, cultural, economic and scientific developments that he considered to be unique to Western civilization. These include empirical technique in the sciences, systematic method in historical scholarship, jurisprudence and canon law, specialized training and bureaucratic organization in the political, technical and economic spheres of life, capitalist organization of the economy, of labor and markets, and the separation of business from the home. In the arts Weber cited the use of the vaulted arch in architecture, linear perspective in painting, and the development of a literature designed specifically for the medium of print. Of music, Weber wrote the following:

The musical ear of other peoples has probably been even more sensitively developed than our own, certainly not less so...All our rational tone intervals have been known and calculated. But rational harmonious music, both counterpoint and harmony, formation of the tone material on the basis of three triads with the harmonic third... our orchestra, with its string quartet as a nucleus, and the organization of ensembles of wind instruments; our bass accompaniment; our system of notation, which has made possible the composition and production of modern musical works, and thus their very survival...our fundamental instruments, the organ, piano, violin, etc.; all these things are known only in the Occident..(Weber, 1958b: 14-15)

The key word in the passage above is: "rational." For Weber, what distinguished Western forms of art, science, economic and political organization from those of other cultures was the degree to which each of these diverse areas of social endeavor had become subject to what he called "rationalization." Indeed, according to Weber the process of increasing rationalization--itself driven by economic and social factors in the West--had become a "primary force" in the transition from traditional to modern modes of thought and action: Weber made use of Schiller's expression, the "disenchantment of the world," in order to characterize this transition (Weber, 1958a: 155).

Through application of the concept of rationalization Weber was able to establish a basic continuity between his social and economic thought on the one hand, and a more general understanding of art and culture on the other. But his very use of the concept over such a wide range of activities also tended, at times, to create contradictions:

Now by this term very many different things may be understood...There is, for example, rationalization of mystical contemplation, that is of an attitude which, viewed from other departments of life, is specifically irrational, just as much as there are rationalizations of economic life, of technique, of scientific research, of military training, of law and administration. Furthermore, each one of these fields may be rationalized in terms of very different ultimate values and ends, and what is rational from one point of view may well be irrational from another. (Weber, 1958b: 26)

Elsewhere, Weber's explanations of his concept tended towards varying degrees of precision and ambiguity: rationalization could mean a kind of "systematic" thinking with "precise and abstract concepts" in one context, or the "methodical attainment" of given goals by "precise calculation of adequate means" in another quite different context; rationalism could be

taken to mean a general "view of life," as during the Renaissance, when traditional beliefs were replaced by a faith in the "naturalis ratio," or simply a "systematic arrangement" of materials and methods (Weber, 1958a: 293-94).

Such apparent contradictions and ambiguities are especially problematic in Weber's work, The Rational and Social Foundations of Music (1958c). In this essay, Weber analyzed the development of Western musical materials and practices--its tonal intervals, scales and harmonic system, its methods of notation, and its musical instruments--and compared it with similar developments in the music of other cultures. While Weber made use of his concept of rationalization throughout this detailed study, he did not supply an explicit working definition of it in relation to music. Recent essays by theorists who have made use of Weber's concept in relation to music offer little insight into Weber's various uses of the term; for example, Michael Chanan defines the rationalization of music as no more than "organization according to clearly articulated principles" (1981: 230).

In this chapter I will attempt to clarify Weber's general concept of rationalization. In doing so, I will offer several brief examples of how it can be applied to the study of musical practice. The "Frankfurt School" theorists have stated that under Western capitalism, rationalism becomes a means to dominate nature and men. In the second part of this chapter I will explore the notion of domination of nature (and men) and its relationship to scientific and technological rationalism (the concept will not be applied specifically to music until Chapter Two). Finally, I will briefly introduce a third concept--that of "simulation"--which is particularly relevant to the study of technology. This concept will be elaborated in Chapter Four.

### Rationalization

The concept of rationalization is derived from Weber's typology of social conduct where "rational," or "goal-oriented behavior is characterized by

the expectation that objects in the external situation or other human individuals will behave in a certain way, and by the use of such expectations as "conditions" or "means" for the successful achievement of the individual's own rationally chosen goals. (Weber, 1962: 59)

In the conceptually pure form of goal-oriented behavior the individual takes into consideration "ends, means, and secondary effects; such conduct must also weigh alternative choices; as well as the relations of the end to other possible uses of the means and, finally, the relative importance of different possible ends" (Weber, 1962: 61). Thus, in purely rational behavior, ends (or goals) may be arranged on a scale in order of priority and the choice of means will be based on their efficiency in achieving the chosen goal.<sup>1</sup>

The necessary balance between ends, means, and secondary effects that is characteristic of rational action can be observed in Weber's description of the "spirit" of capitalism:

Unlimited greed for gain is not in the least identical with capitalism, and still less its spirit. Capitalism may even be identical with the restraint, or at least a rational tempering, of this irrational impulse. But capitalism is identical with the pursuit of profit, and forever renewed profit, by means of continuous, rational, capitalist enterprise. (Weber, 1958b: 17)

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<sup>1</sup>Habermas' translator has used the expression, "purposive-rational," to describe the pure form of rational, goal-oriented behavior. In the work of the "Frankfurt School" the expression, "instrumental reason," describes modes of thought that place an emphasis on the efficiency of means.

In Weber's view, the unlimited pursuit of profit as an ultimate end, and large-scale speculation used as a means; are regarded as "irrational" because they might lead to the destruction of the enterprise over time. In modern capitalism short-term goals and means receive a lower priority than the long-term stability of the enterprise and the maintenance of a regular market.

Weber also described three other modes of social conduct: "value-related" conduct is oriented towards ethical, aesthetic, religious or other absolute standards and values; "affective" conduct is based on an individual's feelings or emotions; and "traditional" conduct is the result of habit, custom or long-standing practice. In relation to goal-oriented behavior, these modes of conduct are essentially "irrational" and, as such, are often in conflict with the demands of rational expediency.

Weber stated that these four categories of behavior did not represent an exhaustive classification of all types of social conduct and, furthermore, "Rarely, is conduct, especially social conduct, oriented only in one or the other of these ways" (1962: 62). It is this latter fact that led Weber to use the concept of rationalization in situations that often appear to be contradictory: for example, in the passage cited earlier, mysticism is clearly a value-related attitude but, depending on the cultural context, the means used in achieving the desired state of unity with the ultimate reality might be relatively methodical, requiring systematic experimentation. The person engaged in such conduct acts according to absolute values or ends but rationally with respect to the choice of means.

Another example of behavior oriented in more than one way can be found in Weber's description of the contrasting roles played by the



magician and the virtuoso in the development of early musical tone systems (Weber, 1958c: 40-42; 46-48; see also, the editor's introduction: xxxv-xxxix). In the cultic or exorcistic rituals of traditional societies the magician makes use of various tone formulae. While these melodic formulae may have originally been derived from some form of early experimentation, once they are determined to be effective they rapidly become "stereotyped" and their exact memorization and execution becomes a matter of considerable importance. By precisely performing the magical formulae in the appropriate contexts the magician acts according to traditional codes of behavior. For Weber, musical rationalization proper begins with the evolution of a secular musical profession. With the rise of vocal and instrumental virtuosi there is a tendency to make use of musical formulae for aesthetic purposes and the previously fixed intervals of the sacred tradition are thus subjected to various kinds of expressive alteration. Furthermore, by experimenting with musical instruments the virtuoso develops expressive techniques and new melodic and harmonic resources which require new forms of codification and systematization. Thus, the virtuoso has a rationalizing influence on the development of early tonal materials despite the fact that his ultimate "ends" are affective in nature. This balance between rational means and irrational ends is inherently unstable (unlike the magician's traditional behavior) because the virtuoso's interest in ever greater levels of expressivity inevitably leads to the dissolution of one musical system after another. In the modern period, with the specialization of the roles of composer and performer, it is the composer who takes on the task of experimentation.

In his essay on music, Weber also referred to musical tones and intervals as being "rational" or "irrational" (clearly, according to his

typology, musical materials themselves cannot be either--they can only be the result of rational or irrational forms of behavior). . Indeed, Weber's use of the term "rational" in relation to different aspects of Western music are so numerous that the relatively abstract, "behaviorist" category outlined above cannot adequately account for them; a more precise definition is obviously required.

In the introduction to The Protestant Ethic and the Spirit of Capitalism, Weber outlines some of the peculiarities of Western capitalism and, in doing so, traces out three distinct elements that characterize the process of rationalization.<sup>1</sup> Firstly, there is a dependence upon calculation. In regards to capitalist enterprise, the ultimate value of any rationally planned economic action and the relative efficiency of the chosen means constantly undergo a process of assessment and calculation in terms of an abstract unit of exchange: capital. Of course, abstract calculation and money have existed elsewhere but nowhere to the extent that they have in the West nor in relation to so many different aspects of economic activity: for example, in modern book-keeping, in the legal separation of corporate and private property, in the development of a regular market and, above all, in the formal organization of free-labor (i.e., wage labor). (Weber, 1958b: 18-22)

More relevant for the purposes of this study of musical technology is the general form of abstraction, quantification and calculation found in the natural sciences which is expressed primarily in terms of mathematics. Underlying many of the unique developments in Western musical

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<sup>1</sup> Marcuse also presents a summary of these three elements of rationalization in his essay, "Industrialization and Capitalism in the Work of Max Weber" (1968: 204).

practice is a form of theoretical knowledge based in mathematics.

For example, in the development of Western pitch materials and tuning systems the concern with mathematical analysis, measurement and calculation begins as early as the sixth century B.C. with Pythagoras' discovery of the correspondence between the interval of a perfect fifth and the ratio,  $3/2$ ; much later, during the seventeenth century, Marin Mersenne formulated the correct mathematical basis for equal temperament tuning as  $\sqrt[12]{2}$ ; and the adoption of hertz (cycles per second) as the standard frequency measurement in electronics has some importance for musical composition with electronic means. In contrast to the West, the Indian musician's concern with subtleties of pitch, scalar materials, and instrumental tuning is developed entirely through the ear and eschews arithmetic measurement entirely (Partch, 1974: 372-73).

In a more general sense, Weber's notion of calculation is related to a kind of planning through abstract means. In this sense, the development of a relatively precise form of notation is an important rationalizing factor in Western music: "Through notation, composition becomes a calculable procedure based on comprehensible principles in a manner otherwise impossible" (Chanan, 1981: 221). The significance of notation in Western music will be taken up in greater detail in the next chapter.

The second characteristic of rationalization outlined by Weber refers to the role played by methodical, scientific experimentation in the development of the technical possibilities upon which modern industrial capitalism depends. What was important for Weber was not only the rigor of scientific method (combined with the precision of mathematics) but also "the technical utilization of scientific knowledge [which, in the West,] was certainly encouraged by economic considerations" (Weber, 1958b: 24-25).

Weber states that "The experiment is a means of reliably controlling experience" (1958a: 141) and that it exists in many spheres of life other than the natural sciences, such as, in yoga technique in India, in the development of war machinery in ancient Greece, and in mining during the Middle Ages. As noted earlier, experimentation with musical instruments appears to be an inherent characteristic of musical development wherever traditional modes of music-making give way to secular professionalism. Indeed, an increasing tendency towards experimentation in music (and in art generally) may have set a pattern in the West that science was only later to adopt and refine:

to raise the experiment to a principle of research was the achievement of the Renaissance. They were the great innovators in art, who were the pioneers of experiment. Leonardo and his like and, above all, the sixteenth-century experimenters in music with their experimental pianos were characteristic. From these circles the experiment entered science, especially through Galileo, and it entered theory through Bacon. (Ibid.: 141-42)

Weber notes that these early experiments with keyboard instruments had musical/theoretical aims. Various musical and cultural factors contributed to the rise of keyboard instruments to a position of dominance in Western music, but perhaps among the most important influences were the economic pressures brought on by capitalism:

the increasing need of music publishers and of concert managers to satisfy the large music consumption of the mass market brought the final victory of the hammer piano.

In the eighteenth century the piano-builders, above all, the German, were still artisans who collaborated and experimented physically (like Silbermann). Machine-made mass production of the piano occurred first in England (Broadwood) then in America (Steinway) ...By the beginning of the nineteenth century the piano had become a standard commercial object produced for stock. (Weber, 1958c: 121-22)

In addition to economic factors, Weber stated that the utilization of scientific knowledge had also been encouraged by the peculiarities of Western social structure, especially its dependence on "a calculable legal system and (on) administration in terms of formal rules" (Weber, 1958b: 25)--in short, bureaucracy. The characteristics of bureaucratic structure, particularly the manner in which they are manifest within industrial capitalism, constitute the third element of Weber's notion of rationalization. In an essay on bureaucracy, Weber outlined a number of its most notable features: "expert training, a functional specialization of work, and an attitude set for habitual and virtuoso-like mastery of single yet methodically integrated functions" (Weber, 1958a: 229). By its very nature, bureaucracy is rational: "rules, means, ends and matter-of-factness dominate its bearing" (Ibid.: 244).

Bureaucracy is also a particular form of social organization in which authority, decision-making, and responsibility are distributed in hierarchical and jurisdictional patterns. A presupposition of bureaucratic structure is the development of a money economy; bureaucracy also accompanies the rise of mass democracy and contributes to the destruction (or displacement) of traditional forms of organization and authority (Weber, 1958a: 196-244).

A detailed study of the institutional context of musical practice is outside the scope of this study. Nevertheless, a number of the characteristics outlined above, especially those which might be related in a general way to the division of labour and the integration of specialized functions might be applicable to various aspects of Western musical practice. The specialization of roles and functions in Western music begins with the development of notation and the increased complexity in musical

forms: "Only the elevation of many-voiced music under notational art created the composer proper..." (Weber, 1958c:88). The more-or-less complete division between composition and performance took several centuries to accomplish and I will summarize certain aspects of this development in the next chapter. The division itself however is not the only one of its kind nor is its existence due to musical factors alone:

Such a division...is characteristic of the division of labour in developing capitalist society. It is clearly associated with the appearance of the conductor to oversee the operation...In the early period of the history of the symphony orchestra he often becomes an entrepreneur, employing the musicians and putting on concerts...[later] he increasingly became the interpretive specialist. (Chanan, 1981: 226-27)

During the Tin Pan Alley era (ca. 1890-1950) one finds a similar specialization of roles in the production of popular songs. Here, the roles of lyricist, composer, arranger, band leader and musician achieve a degree of definition, organization and integration not found in popular music prior to the twentieth century nor in the various "communal" musics (e.g., jazz, blues, and country music) of the same period. Once again, such specialization and integration of functions is, in part, based on the printed score--the score also becomes the commodity which is sold to the public (this will be taken up again in the next chapter). Within the Tin Pan Alley system the task of writing and arranging popular songs tended to be codified into sets of rules or "formulas," thus achieving a high degree of rational, almost "bureaucratic" organizational practice (Peterson and Berger, 1972: 284-89; Hobart, 1981: 263-64; 270-71).

The three elements of rationalization outlined above--calculation through abstract means, methodical experimentation, and the organization

and integration of specialized functions in work--are not mutually exclusive but overlap in a variety of ways. Other applications of Weber's concept of rationalization to music will be taken up in greater detail in the next chapter.

### Social Domination and the Domination of Nature

In his own work, Weber's concept of domination is formulated in strictly sociological terms and is related to a number of other subsidiary concepts: "power" exists, at least potentially, within many forms of social relationship and, as a sociological concept, is therefore somewhat "amorphous"; "domination," on the other hand, is more precise and refers to "the probability that a command will be obeyed;" this probability is related to the level of "discipline" (i.e., a predictable, practiced orientation towards obedience) exhibited by a given group of persons. As noted earlier, Weber was particularly interested in the nature of "corporate domination," where domination and discipline are dependent on the structure of an "administrative organization" (bureaucracy) and a legitimized system of authority (Weber, 1962: 117-18).

In the West, domination is not simply a social category however, it has been indissolubly linked with, and disguised by, the development of another form of domination--the scientific and technological domination of nature. This argument has been made by, among others, the "Frankfurt School" theorists (Horkheimer and Adorno, 1972; Marcuse, 1964, 1968), and perhaps most clearly developed in a work by William Leiss entitled, The Domination of Nature (1972). The main contours of the argument might be summed up as follows:

(1) the effort to master and control nature has an essential connection with the modern utopian vision; (2) the mastery of nature is achieved by means of scientific and technological progress; (3) the attempt to master external nature has a close and perhaps inextricable relationship with the evolution of new means for exercising domination over men—or, alternatively, human activity becomes so much a part of the natural environment that mastery of nature and mastery of man are only two aspects of the same process. (Leiss, 1972: 15-16)

In the passage quoted above, there is a clear shift from a utopian vision of "mastery of nature"<sup>1</sup> (the satisfaction of man's basic needs), to a dystopian one (the development of new means of social repression). In the "Frankfurt School" version of this argument the utopian vision of scientific progress was embodied in Enlightenment thought: "the disenchantment of the world; the dissolution of myths and the substitution of knowledge for fancy" (Horkheimer and Adorno, 1972: 3). But as the old myths were shattered, so too was the value system of the previous social order and the sense of "meaning" in the world upon which it was based. Weber had also recognized this fact when he asked the following question: "Now, this process of disenchantment, ... this 'progress,' to which science belongs as a link and motive force, do they have any meanings that go beyond the purely practical and technical?" (Weber, 1958a: 139). For the "Frankfurt School" (and, ultimately, for Weber as well), the answer to this question was a resounding, "No." Enlightenment thought could not generate "meaning" from within its own discourse; therefore, the ends towards which scientific knowledge would be directed could only be determined by the simultaneously evolving economic logic of capitalism.

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<sup>1</sup>It should be noted that throughout Leiss' work, as in the literature that he uses as source material, the terms "domination," "mastery," "control," or "conquest" of nature are used interchangeably.



For Weber, Western capitalism was at least still guided by rational restraint--the "Protestant ethic"--but the "Frankfurt School" argued that in the twentieth century capitalist rationality takes on a distinctively "irrational" character, both in its tendency towards exploitation and destruction:

the struggle for existence and the exploitation of labor must be intensified more and more if increased accumulation is to be possible. "Planned obsolescence," methodical irrationality, becomes a social necessity... the capital accounting of mathematized profitability and efficiency celebrates its greatest triumphs in the calculation of kill and overkill, of the risk of our own annihilation compared with that of the annihilation of the enemy. (Marcuse, 1968: 207)

Within the context of a capitalism that knows no restraint, scientific knowledge becomes a form of pure means, pure instrumentalism: "What men want to learn from nature is how to use it in order wholly to dominate it and other men. That is its only aim" (Horkheimer and Adorno, 1972: 4).

Domination in the West has a specific character. Since the Enlightenment, it has been expressed as a form of "objectification"<sup>1</sup> through reason and mathematization: "Formal logic was the major school of unified science. It provided the Enlightenment thinkers with the schema of the calculability of the world...number became the canon of the Enlightenment" (Ibid.: 7). Objectification of natural processes is complemented by the objectification of man's relations with man: "The same equations dominate bourgeois justice and commodity exchange" (Ibid.: 7); and this is

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<sup>1</sup>The greater part of Horkheimer and Adorno's argument is concerned with how objectification generates fundamental contradictions within Enlightenment thought: "myth is already enlightenment; and enlightenment reverts to mythology" (1972: xvi). This aspect of their work, though of fundamental importance to their argument as a whole, is outside the scope of this thesis.

especially evident in the techniques utilized by the "culture industry," in the "classifying, organizing and labeling of consumers...Consumers appear as statistics on research organization charts" (Ibid.: 123).

The importance of the social and economic context of capitalism on the development of science and technology and, indeed on Weber's notion of rationalization itself, is outlined in Herbert Marcuse's essay, "Industrialization and Capitalism in the Work of Max Weber" (1968). In part, Marcuse's critique of Weber is characterized by a concern with objectification through number that is not unlike that of Horkheimer and Adorno:

The basis of this rationality is abstraction... the reduction of quality to quantity. As universal functionalization...it becomes the precondition of calculable efficiency. Abstract reason becomes concrete in the calculable and calculated domination of nature and man. The reason envisioned by Weber thus is revealed as technical reason, as the production and transformation of material (things and men) through the methodical-scientific apparatus...its rationality organizes and controls things and men, factory and bureaucracy, work and leisure. (Marcuse, 1968: 205; in this, and all subsequent quotations from this essay, the emphasis is Marcuse's)

Marcuse points out that in Weber's work the concept of rationalization is itself abstract, "formal." He describes how Weber had seen that the trend towards increasing rationalization reached its fullest development under capitalism and, as a result, theorized that the specific type of domination associated with it--"total bureaucracy"--had become the objective "fate" of Western civilization (Ibid.: 203). Marcuse's critique of Weber is concerned with the manner in which his "formal," "value-free" notion of rationality turns into capitalist rationality (planned economy) and domination (the separation of the workers from the means of production)

and their subjection to a "work discipline" under the direction and authority of the entrepreneur) as "fate": "The highly material, historical fact of the private-capitalist enterprise thus becomes (in Weber's sense) a formal structural element of capitalism and, of rational economic activity itself" (Ibid.: 212). Marcuse argues that this conflation of economic rationality and capitalism in Weber's work is significant because it prevents Weber from considering a socialist planned economy as leading to anything except even greater levels of rationalization, bureaucratization and hence, domination. Marcuse flatly rejected this aspect of Weber's work and suggested that a rationally planned socialist economy would not necessarily result in domination (Ibid.: 215). Marcuse realized that his point of view was utopian (he readily admitted this; Ibid.: 225) but he found it possible to make such an assertion because for him, rationality (whether it is conceived in political, economic, scientific, or technical terms) was not abstract, or formal, it was material and historical: "technical reason is historical. If separation from the means of production is a technical necessity, the bondage that it organizes is not" (Ibid.: 225).

In the discussion of Marcuse's ideas presented above, it might appear that he perhaps viewed technology itself as "neutral": as a simple tool or machine whose use, good or bad, is contingent upon social and political factors. His view of the relationship between technology and society was more complex than this however:

The very concept of technical reason is perhaps ideological. Not only the application of technology but technology itself is domination (of nature and men) --methodical, scientific, calculated, calculating control. Specific purposes and interests of domination are not foisted upon technology "subsequently" and from the outside;

they enter the very construction of the technical apparatus. Technology is always a historical-social project. (Marcuse, 1968: 223-24)

The link between science, technology and domination as "historical-social project" is the subject of William Leiss' book, The Domination of Nature (1972). In his book, Leiss traces the history of the concept of "domination of nature" and describes how its meaning and its historical function have changed over time. The central figure in Leiss' study is the seventeenth-century English philosopher, Francis Bacon, whose "great achievement was to formulate the concept of human mastery over nature much more clearly than had been done previously and to assign it a prominent place among men's concerns" (Leiss, 1972: 48).

Bacon argued that the goal of the natural sciences and the mechanical arts (later, technology) was to extend man's power over nature, thereby increasing the possibilities for the satisfaction of human needs. In this way, the advancement of science and technology, and indeed the physical (and social) well-being of man, became thoroughly identified with the domination of nature.<sup>1</sup>

With the aid of his inventions, man would "have the power to conquer and subdue [nature], to shake her to her foundations" (Bacon, in Leiss, 1972: 58). In order to gain the knowledge necessary for the domination of nature it was possible to simply observe natural processes, to "hound nature in her wanderings." But even greater knowledge would be gained by organized, experimental research and the application of technical means

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<sup>1</sup>Leiss provides a fascinating account of how Bacon justified this goal by making use of Christian doctrine. Bacon argued that it was God's plan that man should regain the dominion over creation that had been lost by him as a result of the Fall.

(the mechanical arts): "the nature of things betrays itself more readily under the vexations of art than in its natural freedom...that is to say, when by art and the hand of man she is forced out of her natural state, and squeezed and moulded" (Ibid.: 59). What is interesting in this passage, especially with regard to the study of technology and ideology, is the manner in which knowledge and power, originally vested in nature, comes to be vested in man and his technologies: "attention was shifted from nature as the source of marvels and new powers to the human instruments whereby these natural forces were discovered, integrated, and made serviceable for man's purposes" (Leiss, 1972: 76).

Bacon realized that the development of science and technology required not only a philosophical basis but also, on a practical level, the creation of a research environment that would be conducive to the advancement of new scientific methods:

Bacon aimed both at changing the prevailing cultural and philosophical attitudes and equally at effecting drastic institutional reforms. The great idea which possessed him all his life was that of organized scientific research; he drafted many different proposals during his years in government service before sketching in his old age the vision which was to cast a spell over all succeeding generations, namely, that of a research establishment for science and technology--called Solomon's House or the "College of the Six Days' Works"--which is described in his New Atlantis (1627). (Ibid.: 46)

There were both positive and negative aspects to Bacon's philosophy and his ideas on institutional reform. Certainly, the idea of a systematic scientific method and mastery over nature was a qualitatively different approach from that of ancient myth, religion and alchemy, but

Its negative dimensions--so well disguised in Bacon's New Atlantis--were its exclusive focus on modern science

and technology' as the designated instruments for the mastery of nature and its ability to mask the connection between their development on the one hand, and the persistence of social conflict and political domination on the other. (Ibid.: 177)

Leiss argues that it was the spectacular triumph of science and technology (over nature and the older dogmas) that has brought their negative aspects to the fore in the twentieth century, such that "The only remedy for social ills is said to be the ever more competent scientific and technological mastery of nature" (Ibid.: 177-78).<sup>1</sup>

Thus far, I have used the terms "science" and "technology" indiscriminately in relation to the concept of domination of nature. There is, however, a theoretical distinction (the significance of which will become clear in the following chapters) that can be made between these two spheres (the scientific and the technical) and their individual relationships with nature. Such a distinction has already been implied earlier in this chapter with regards to Weber's interest in scientific experimentation and the technical utilization of scientific knowledge which is guided by factors external to science. The distinction can be framed in the following manner:

"Techniques" comprise not only tools but equally as importantly the organization and training of human labor...The purposeful organization and combination of productive techniques, directed either by public or private authorities, has been called "technological rationality." Depending upon the level of cultural development, it is normally linked with a specific type of scientific rationality, that is, with a more abstract understanding of nature's physical processes. (Leiss, 1972: 199)

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<sup>1</sup>A similar argument concerning science and technology as "ideology" is made by Marcuse, (1964), and Habermas, (1970).

Leiss' separation of scientific and technological rationalization is derived from Husserl's critique of the modern science of Galileo and the philosophy of Descartes. It is based on the idea that the "nature" which is the object of scientific mastery has been separated off, conceptually, from the nature which we experience in everyday life. The aim of science is to go beyond the level of surface appearance to the underlying structure of matter where a certain mathematical and geometric unity can be discerned. In this way, science is abstract, it objectifies nature and casts a "veil of ideas" (Husserl's expression) over it:

The scientific understanding of nature strives for the elaboration of a theoretical system... (the mathematization of nature)... The idea of internal harmony, order, and regularity among the occurrences and behavior of natural phenomena... Mastery of nature in this sense means the increasing refinement of a theoretical scheme which explains that behavior consistently. (Leiss, 1972: 139-40)

Technology on the other hand supplies the link between this abstract, scientific understanding of nature and the mastery of nature in practical, everyday life: technology is therefore more closely tied to human needs and social conflicts. Leiss' argument is that technological rationality must be separated (for analytical purposes) from scientific rationality so that the relationship between technology and society can be clearly revealed; this is, in turn, important for an understanding of the notion of domination of nature:

mastery of nature develops also in response to other aspects in the social dynamic, for example the process whereby human needs are formed, and therefore its meaning with respect to technology may be quite different than it is in the case of science... mastery of nature is not a project of science per se but a broader social task. (Ibid. 146; Leiss' emphasis)

This distinction is the basis of Leiss' critique of what has become, since the time of Bacon, the conventional wisdom: that scientific and technological progress is "'automatically' transformed into mastery over nature considered as social progress (a reduction in the sources of social conflict)" (Ibid.:140).

It should be noted that the distinction between science and technology is made for analytical purposes only. Leiss states that historically, modern science and technology have become involved in an ongoing interaction and he discusses the theory of Max Scheler and Marcuse which states that in practice, "The science of nature develops under the technological a priori which projects nature as potential instrumentality, stuff of control and organization" (Marcuse, 1964: 453). The "Frankfurt School" concern with "number" and "formal logic" as the guiding concepts of Enlightenment thought is based on this notion of a "technological a priori": "the modern sciences produce knowledge which through its form (and not through the subjective intention of scientists) is technically exploitable knowledge" (Habermas, 1970: 99). Still, Leiss would maintain that the analytical distinction must be made in order to understand the dynamic relationship that exists between science and technology; for rational, scientific knowledge cannot be said to have any "power" of its own except in relation to its technological application (Leiss, 1972: 122).

Today, science and technology continue to be framed as the answer to social and economic problems while, at the same time, the control of their destructive potential (social and environmental) serves as the basis of legitimization of state power: thus, science and technology have become the "glassy background ideology" of contemporary capitalist society (Habermas, 1970: 111). Alternatives to the ideological constellation



formed by science, technology, domination and social and economic progress have been proposed by a number of the theorists mentioned above. Marcuse suggested that there is perhaps a form of mastery that can lead to the "liberation" of nature rather than its domination:

the change in the direction of progress, which might sever this fatal link [with the domination of nature and man], would also affect the very structure of science--the scientific project. Its hypotheses, without losing their rational character, would develop in an essentially different experimental context (that of a pacified world); consequently, science would arrive at essentially different concepts of nature and establish essentially different facts. (Marcuse, 1964: 166-67)

Stated in its most simplified form, what Marcuse perhaps means by "different concepts of nature" is, for example, the manner in which "Cultivation of the soil is qualitatively different from destruction of the soil" (Ibid.: 240). Thus, "The task of mastering Nature ought to be understood as a matter of bringing under control the irrational and destructive aspects of human desires" (Leiss: 1972: 193). Such a solution however (while certainly not unworthy) merely casts one back upon a form of pure rationalism (in Weber's sense) where "secondary effects" are given their due regard and man's acquisitive desires are kept in check. But Marcuse provides no real idea of the social framework in which such changes are to take place.

At a somewhat different level, Habermas has suggested that what Marcuse was interested in was an alternative attitude towards nature, one that recognizes nature as another "subject," as the "Other." "The alternative to existing technology, the project of nature as opposing partner instead of object, refers to an alternative structure of action: to symbolic interaction" (Habermas, 1970: 88). Continuing, Habermas

states that Marcuse's idea of a "New Science" or a "New Technology" does not, in itself, "stand up to logical scrutiny" (Ibid.), and that the concept of "interaction" cannot be limited to a "symbolic" one between man and nature, but must also take the form of a socially active one between man and man.

In his essay, "Technology and Science as 'Ideology'" (1970), Habermas takes up Weber's concept of rationalization and refers to it as "purposive-rational action" (or simply "work"). He defines it as the realization of defined goals through a specific organization of means, strategies, rules, etc. Against this he poses a second category, that of "interaction" (or "communicative action"). The latter "is governed by binding consensual norms, which define reciprocal expectations about behavior and which must be understood and recognized by at least two acting subjects" (Ibid.: 92). Habermas also uses these same categories in a reformulation of Marx's framework for the study of historical materialism. He states that the effects of science and technology are first felt at the level of "work" in that they are designed to contribute to the expansion of the "forces of production." But they also have secondary effects in the manner in which they alter the institutionalized forms of "interaction" (or the "relations of production").<sup>1</sup> Habermas' concern is with the expansion of a democratic institutional framework for the development of rational "communicative action"--a framework in which the development of science and technology will be guided by those affected by it rather than the political and economic elite presently in control of it. Leiss concurs with this position:

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<sup>1</sup>I have elaborated on Habermas' concept of "work" and "interaction" because I intend to make use of it later in the thesis, albeit in a somewhat more limited social context.

The secular foundations of the mastery of nature in this new sense [one in which man has brought his destructive drives under control] would be a set of social institutions in which responsibility and authority are distributed widely among the citizenry and in which all individuals are encouraged to develop their critical faculties. (Leiss, 1972: 197)

The various "alternatives" outlined above are rather abstract and far-reaching. They call for a fundamentally different concept of "nature" and man's relationship to it, a different approach to scientific and technological research, and/or wide-spread social and institutional reform. There is at least one other concept of "alternatives" with regard to technology that should be taken up here however--one that is perhaps more modest, more contingent, more concerned with social practice and the use of technology than with the "larger" theoretical issues of science, technology and domination. I am referring to Raymond Williams' work on television (1974) in which he articulates a position concerning technology and its "intended" purposes and effects, and the possibility of other, parallel or oppositional uses that arise out of the day-to-day contexts of social practice:

all technologies have been developed and improved to help with known human practices or with foreseen and desired practices. This element of intention is fundamental, but it is not exclusive. Original intention corresponds with the known or desired practices of a particular social group...other social groups, sometimes with other intentions or at least with different scales of priority, will adopt and develop the technology, often with different purposes and effects. Further, there will be in many cases unforeseen uses and unforeseen effects which are again a real qualification of the original intention. (Williams, 1974: 129)

Without depriving himself of the critical "edge" and the insights found in more theoretical works such as those of the "Frankfurt School,"

Williams places himself in clear opposition to their more "totalizing" critiques: for example, much of what has been presented above tends to imply that science and technology are totally determined by social, political and economic forces and thus embody, as it were, the essence of domination. Williams rejects the notion of a totally "determined technology":<sup>1</sup>

Determination is a real social process, but never... as a wholly controlling, wholly predicting set of causes. On the contrary, the reality of determination is the setting of limits and the exertion of pressures, within which variable social practices are profoundly affected but never necessarily controlled. We have to think of determination not as a single force, or a single abstraction of forces, but as a process in which real determining factors... set limits and exert pressures, but neither wholly control nor wholly predict the outcome of complex activity within or at these limits, and under or against these pressures. (Ibid.: 130)

Despite the relatively limited amount of space that has been devoted to Williams' ideas here, their importance will become more evident in later chapters of the thesis. For while the concept of rationalization and the notion of domination of nature (and men) will be regarded throughout this study as a dominant, broadly defined and understood set of social and historical attitudes towards technology--attitudes that contribute to the development of various "intentions" and "practices"; it will also be important to remember that society is complex, that the "rational" and the "irrational" can, and do coexist, and that any given set of attitudes, even those considered to be dominant within a society,

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<sup>1</sup>Williams uses this expression as a complement to the more familiar notion of "technological determinism" (e.g., the ideas of Marshall McLuhan), which he also rejects on the grounds that it is a "formalist" theory and that it too disregards actual media practices.

cannot fully account for all the possible intentions, uses and practices associated with new (or for that matter old) technologies.

Leiss has shown how science and technology came to be regarded as a means to dominate nature and thus aid in the satisfaction of man's basic needs. But this same movement towards greater control over nature has also resulted in the possibility of greater social control exercised by political and economic elites. This social domination is not overt however: it manifests itself in the form of individual "needs"—artificially stimulated by advertising and never quite fully satisfied by commodities themselves—thus becoming an internalized domination (Leiss, 1972: xvi; see also Horkheimer and Adorno, 1972: 120-167).

There is another sense in which social domination has become difficult to locate in society, one that is not so much related to the "false consciousness" of advertising and consumption as it is to the advancement of technological sophistication: that is, to the possibility of simulating human activity such that social domination becomes "latent." It is to this last concept—"simulation"—that I would now like to turn.

#### A. Note on the Idea of Simulation

The concept of "simulation" that I would like to introduce here is based on a certain way of thinking about technology that is derived from the work of Jurgen Habermas. I will not develop the concept at length here as I intend to elaborate on various aspects of it in Chapter Four where I deal with technology in popular music.

In his essay, "Technology and Science as 'Ideology'" (1970: 81-122), Habermas summarizes Arnold Gehlen's description of the development of

technology. On the surface, this description resembles McLuhan's notion of technology as "extensions" of man's body and mind (see McLuhan, 1964) but Habermas is less interested in technology as form than in how it relates to his categories of "work" and "interaction" described earlier in this chapter:

technological development lends itself to being interpreted as though the human species had taken the elementary components of the behavioral system of purposive-rational action, which is primarily rooted in the human organism, and projected them one after another onto the plane of technical instruments...At first the functions of the motor apparatus (hands and legs) were augmented and replaced, followed by energy production (of the human body), the functions of the sensory apparatus (eyes, ears, and skin), and finally by the functions of the governing center (the brain). Technological development thus follows a logic that corresponds to the structure of purposive-rational action regulated by its own results, which is in fact "work." (Habermas, 1970: 87)

The greater efficiency in production that results from this technological development tends to devalue labor and thus renders Marx's labor theory of value obsolete: "It is no longer meaningful to calculate the amount of capital investment in research and development on the basis of the value of unskilled (simple) labor power, when scientific-technical progress has become an independent source of surplus value" (Ibid.: 104). In a sense, capitalism has become less and less dependent upon labor and the terms in which Marx originally framed the class struggle have become largely irrelevant.

As noted earlier, Habermas' argument also states that as the structures of rational behavior (work) are transferred to machines there is a corresponding displacement of human "interaction." This displacement, originally a by-product of technological development, may now be part of

a general trend towards the conscious organization of social systems in accordance with patterns of man-machine systems (Ibid.: 106):

the behavioral system of purposive-rational action, not only predominates over the institutional framework but gradually absorbs communicative action as such... For the first time man can not only, as "homo faber," completely objectify himself and confront the achievements that have taken on independent life in his products; he can in addition, as "homo fabricatus," be integrated into his technical apparatus... (Ibid.)

At the time that he wrote his essay (ca. 1968), Habermas stated that social integration into the technical apparatus had not, as yet, even begun to take place. He did however, see evidence that newer technologies could contribute to the erosion of social systems based on communicative action.

It is to this latter possibility in Habermas' discussion of technology that I would like to apply the term "simulation."<sup>1</sup> For what recently developed technologies (in the case of the present study: multitrack studios in pop music production) do is not simply perform "work" in a manner that is more efficient than man's own labor; what is significant about these technologies is that they substitute a work discipline for interaction precisely in the manner in which they are able to simulate interactive behavior itself. I am consciously extending Habermas' notion of interaction here to include various types of musical practice such as ensemble performance. In his own theory, Habermas limits interaction to communication through language. I see no particular reason to limit the notion of communicative action in this way.

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<sup>1</sup>My choice of the term "simulation" is influenced by a number of works by Jean Baudrillard. Baudrillard most often makes use of the term in relation to mass media therefore my use of the term here is somewhat different than his own.

Habermas states that the erosion of communicative action is accompanied by patterns of "conditioned behavior...steered by external...(and) fabricated stimuli...Sociopsychologically, the era is typified less by the authoritarian personality than by the destructuring of the superego" (Ibid.: 107). Under such conditions power cannot be "clearly localized" in society and domination, as such, becomes "latent."<sup>1</sup> Rather than continue this line of argumentation here I will instead take this up again and develop it in relation to musical technology in later chapters.

### Conclusion

In this chapter I have attempted to clarify Weber's concept of rationalization and to illustrate its relevance to the study of music through several brief applications of the concept to different aspects of musical practice. Rationalization was defined as a form of goal-oriented behavior where the "ends" of action are freely chosen and the "means" towards such ends are chosen in view of their efficiency in achieving the chosen goal. Rational behavior is necessarily based on a comparison of possible means and their secondary effects through

- 1) prior calculation (measurement and planning through abstract means);
- 2) systematic observation and experimentation; and finally, rational behavior in work is characterized by 3) bureaucratic structures of organization (methodical integration of specialized functions). Rational behavior was compared to three other forms of behavior: value-related, affective, and traditional.

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<sup>1</sup>I have deliberately altered the terms of Habermas' argument somewhat here to suit my own purposes; in Habermas' essay it is "class conflict" that becomes "latent." There are also aspects of his argument that have not been taken up here: such as, the role of the state in alleviating the dysfunctional side-effects of capitalist economy.



Rationalization is closely related to a seventeenth-century philosophical movement that advocated mastery over nature through science and technology. Francis Bacon, Descartes, and others advocated the "domination of nature" as a means to overcome older modes of thought and action and as a means to satisfy man's basic needs. Two specific, but related forms of rationalization were defined--the scientific and the technological--each with their own distinct pattern of "domination." Under capitalism, the domination of an objectified nature through technological means led to an unleashing of productive forces unprecedented in history. Through the objectification and reorganization of productive relations capitalism has also led to new forms of social domination--domination of nature is thus linked with the domination of man.

With reference to the increasing rationalization of work and the development of new technologies I have briefly introduced a third concept: "simulation." Here, productive relations are not only reorganized but actual patterns of human communication and "interaction" come to be the object of technological simulation.

These three concepts--rationalization, domination of nature (and man), and simulation--constitute a theoretical and analytical framework through which the role of technology in musical practice can be studied. It is to such a study that I would now like to turn.

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## CHAPTER TWO

WEBER AND ADORNO:

### RATIONALIZATION AND DOMINATION IN MUSIC

Weber applied his concept of rationalization to the study of human behavior in both comparative and historical frameworks. Leiss' study of the idea of domination of nature (and man) is essentially historical and analytical. While the main topic of this thesis is the application of these theories (and to a lesser extent, the idea of simulation) to the study of technology in recent musical practice, some degree of consideration for their applicability to music in a larger historical framework would seem appropriate, if not essential, to this study.

In his book-length essay, The Rational and Social Foundations of Music (1958c), Weber set out to investigate the extent to which Western musical materials and practices had become organized according to "rationalized" modes of thought and action. Here, Weber applied his concept of rationalization in a wide-ranging study of Western and non-Western music thus demonstrating the degree to which rational and irrational forces may be detected in all musical systems and, more importantly, the peculiarity of Western music's historical drive towards ever increasing levels of rational organization.

Weber's study was written about 1911 and thus predates a number of major changes in Western musical practice—both in the area of art music and popular music. However, a sense of the continued development of

Western music in the direction of greater levels of rationalization can be gained through a consideration of the work of Theodor Adorno. His book, The Philosophy of Modern Music (1973), especially the essay entitled, "Schoenberg and Progress," is of particular importance for the study at hand because it is here that Adorno makes an explicit link between Schoenberg's compositional strategies and the concept of "domination of nature." Schoenberg's twelve-tone technique of musical composition is of critical importance in any consideration of the post-World War II era of avant-garde music—instrumental or electronic.<sup>1</sup>

Adorno's work in the area of popular music will also be considered (while Weber's essay deals with the music of many different cultures, he makes only passing reference to Western folk and popular musical forms). Implied throughout his various works on popular music, and the "culture industry" in general, are the ideas of "false consciousness" and the domination of man. While Adorno's work can be insightful, it is also highly problematic and will therefore be complemented with arguments from a number of other authors. In this way, I hope to create the kind of perspective that I would like to pursue in later chapters.

This chapter will be divided into two parts. In the first part I will attempt to apply the concepts of rationalization and domination to various aspects of art music as it has developed historically in the West.

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<sup>1</sup>A thorough discussion of modernism in music is outside the scope of this study. In this and subsequent chapters reference will be made to specific composers and their work as a way of illustrating certain arguments. Such references should not be taken as constituting a position with respect to modernism (or a specific composer's work) as a whole. Adorno's book also contains a polemical essay on Stravinsky. His arguments concerning Stravinsky's music as the polar opposite to that of Schoenberg and the overall relationship of their music to the "dialectic of enlightenment" will not be discussed in any detail here.

Weber and Adorno's work on music will be used as a guide here but no attempt will be made to summarize their work as a whole. Instead, a number of key musical issues related to the thesis will be addressed: the relationship of harmony and melody, instrumental tuning, timbre, notation, the relationship of the composer and the performer and, briefly, some influences of early sound recording. Popular music of the Tin Pan Alley and early jazz era will be taken up in part two. A set of issues similar to that listed above will be addressed but the emphasis placed on each will be quite different. A number of Adorno's ideas concerning popular music will be critiqued and a view of the relationship between recording and popular music quite opposed to that of Adorno will be introduced.

#### The Tradition of Western Art Music

The bulk of Weber's essay on music is concerned with the manner in which the tonal materials of music have been conceptualized, calculated, and put into practical use. One of its aims is to demonstrate the unique development of the Western tonal system along the lines of rationalized harmonic thinking. I will not go into detail here describing Weber's various speculations regarding the origins of the tone system but will merely point out one of his main theses: Weber states that the Western tonal system is the result of a conceptualization of musical tones based on the interval of a fifth (which is arrived at harmonically through instrumental tuning) and that this leads to a relatively high degree of calculation and a rigid fixing of melodic intervals and scales; the music of various other cultures is based on the interval of a fourth (which is

arrived at melodically) and this allows for a variety of melodic intervals and scales that are only partially calculated or fixed (for example, such musics may make use of microtones, neutral thirds, glissandi between pitches, etc.; Weber, 1958c: 51-65). Harmonic thinking eventually led to the development of a highly rationalized system of scales, chords, and chordal movement called "tonality." Far from being totally rationalized however, Western music regains some degree of tonal freedom through the use of dissonant, chromatic melodicism. Throughout his argument Weber consciously sets up a polarity between the rational/harmonic and the irrational/melodic (irrational in the sense that chromaticism is used as an expressive device and thus represents an "affective" form of behavior). For Weber, Western music exists within the tension created by these two poles:

Without the tensions motivated by the irrationality of melody, no modern music could exist. They are among its most effective means of expression...chordal rationalization lives only in continuous tension with melodicism which it can never completely devour. (Weber, 1958c: 10; The term 'modern' in this passage refers to tonal music of the eighteenth and nineteenth centuries.)

Weber's argument can be illustrated and partially supported through a brief look at one of the founding theoretical texts of modern harmony. In his Traité de l'harmonie, published in 1722, Jean-Philippe Rameau states that "Music is a science which ought to have rules; these rules ought to be derived from a self-evident principle; and this principle can scarcely be known to us without the help of mathematics" (Rameau, 1950: 566). The "self-evident principle" that he refers to is the natural harmonic series observed in the vibrations of strings and pipes from which the fundamental chord of tonal music--the triad--is derived. Rameau's

conception of music is thoroughly rational--scientific, methodical, and mathematical. An interesting aspect of Rameau's Traité is the manner in which he attempts to use the harmonic principle not only to direct the formation of chords and their progressions, but to direct the course of melody as well:

At first sight it would seem that harmony arises from melody...it has, however, been necessary to determine in advance a path for each of these voices in order that they may agree together. No matter, then, what order of melody we may observe in the individual parts, taken together they will scarcely form a tolerable harmony... unless this order has been dictated to them by the rules of harmony. (Ibid.: 570)

Harmony is regarded by Rameau as a rational means of planning polyvocal music and, as such, it tends to absorb melodic movement. Later however, in speaking of melody, he concedes that "it is almost impossible to give certain rules for it, since good taste is here more influential than other considerations" (Ibid.: 573).

The tensions between rational harmony and irrational melody that Weber regarded as so fundamental to Western musical expression are completely dissolved in the music of Arnold Schoenberg during the early twentieth century. In Schoenberg's music both harmony and melody are determined by the all-encompassing order of the twelve-tone row:<sup>1</sup> "every tone of the composition, without exception, has its positional value in the row, or one of its derivatives. This guarantees the 'indifference' of harmony and melody" (Adorno, 1973: 63). With regards to the organiza-

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<sup>1</sup>Schoenberg's twelve-tone method of composition is based on an arbitrary ordering of the twelve tones of the chromatic scale; a different ordering is chosen for each work. Unlike the use of scales in music, the order of the tones must be followed throughout the work (various techniques such as transposition, inversion, etc. are used in order to introduce variety). Use of the technique guarantees an unprecedented homogeneity and unity of melodic and intervallic materials (see Adorno, 1973: 60-64).

tion of pitch material, Schoenberg's technique is rational in the extreme --all melodic and intervallic relationships are calculated in advance of the actual composing of the work.

This is not to say that Schoenberg's music is not expressive but that its expressive quality is derived from other sources than the "tensions" described by Weber. Adorno states that Schoenberg's music (especially that of his early, pre-twelve-tone "Expressionist" period) registers its emotional content directly, and crudely, through the polarization of extremes: "towards gestures of shock resembling bodily convulsions on the one hand, and on the other towards a crystalline standstill"(Ibid.:42).<sup>1</sup> But the adoption of the twelve-tone method tends to place constraints on the composer, alienates him from his material and denies the possibility of "subjective" expression. The rational, "objective" organizational structuring of the musical elements can degenerate into a kind of fetishistic formalism. Adorno claims that Schoenberg transcends these tendencies within the organizational system but that the result of such alienation can be observed in some of the later works of Schoenberg's student, Anton Webern:

The self-determined law of the row truthfully becomes a fetish at that point when the conductor relies upon it as the source of meaning. The fetishism of the row is striking in Webern's Piano Variations (opus 27), and in the String Quartet (opus 28). These compositions offer nothing more than uniform symmetrical presentations of the miraculous row...In Webern the musical subject grows silent and abdicates; it delivers itself up to the material. (Ibid.: 111-112)

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<sup>1</sup> Both Adorno and Walter Benjamin have made frequent use of the idea of "shock" in describing modern works of art and literature. In Benjamin's work especially (see various essays in Illuminations, 1968), shock is a basic aspect of the experience of modernity and thus closely resembles Williams' notion of "structures of feeling" (Williams, 1977: 128-135).

It is interesting to note that it is the music of Webern, not Schoenberg, that becomes the most influential on the post-War avant-garde.

In modern music, rational organization is extended into areas previously uncontrolled, or only partly controlled, by the composer. The area traditionally known as "orchestration" is a case in point. During the Baroque period musical ensembles were still relatively unstandardized and composers sometimes did not even specify what instruments were to play a given melodic part. As is evident in the quotation at the beginning of Chapter One, Weber regarded the organization of the orchestra into standardized groupings of instruments during the Classical period as a step towards rationalization. Still, the "art" of orchestration was a relatively undeveloped aspect of compositional technique at least until the mid-nineteenth century when Hector Berlioz began his bold experiments with orchestral instrumentation (he also published the first significant book on the subject in 1844 entitled, Traité d'instrumentation et orchestration modernes).

With Schoenberg's concept of "Klangfarbenmelodie" (tone-color melody), instrumental timbre became, perhaps for the first time, a structural element of modern music: "In the compositional theory of Schoenberg's middle period, 'Klangfarbe' melody had its definitive function. It was thereby intended that the changes of color were to become a compositional event in themselves and to determine the course of the composition" (Adorno, 1973: 88). As will be shown in the following chapters, the rational structuring (or re-structuring) of timbre by technological means is an important aspect of avant-garde and popular music in the post-World War II era.



In comparison to music of an earlier time, the level of rationalization exhibited by the twelve-tone method of composition does not only represent a difference in degree but a difference in kind. For Adorno, Schoenberg's method represents a system of "total organization" and control; "there is no longer a single 'free' note" (Ibid.: 62). Within such a system, rationalization becomes domination:

A system by which music dominates nature results. It reflects a longing present since the beginnings of the bourgeois era: to "grasp" and to place all sounds into an order and to reduce the magic essence of music to human logic... The conscious disposition over the material of nature is two-sided: the emancipation of the human being from the musical force of nature and the subjection of nature to human purposes. In Spengler's philosophy of history the principle of blatant domination breaks through at the end of the bourgeois era. (Ibid.: 64-65)

In this passage Adorno makes use of the notion of "domination of nature" in a very specific way: he does not mean the domination of an external, objective "Nature" so much as the domination of a particular, historically defined notion of a "musical" nature.

In order to make sense of Adorno's statement it might be useful to refer back to the distinction between scientific and technological rationalization, made in the previous chapter, where scientific rationalization concerns itself with "the elaboration of a theoretical system," with notions of a unified, mathematized law that governs natural phenomena. Clearly, Rameau's description of music quoted above is in keeping with this definition of scientific rationalism: Rameau had attempted to limit the selection of tones used in the construction of chords to those that conform to the "self-evident principles" of order and harmony observed in the natural vibrations of strings. Thus, "the musical force of nature,"

as mentioned by Adorno, is in some way embedded within the tonal system of music (both at the level of theory and in the sound of triadic harmony itself). It should be stressed however that triads and especially the rules governing chordal progression in tonal music are not in themselves "natural"; nothing that can be observed in the vibration of strings suggests that lower order harmonics should be considered as "consonant" and higher ones considered as "dissonant." Once in place, the system does take on the appearance of natural forces in that there exists a kind of structural cohesion between chordal harmony and the overtone series.

In describing the variety of chordal constructions made possible (and theoretically justifiable) by the twelve-tone method of composition, Adorno states that

All restricting principles of selection in tonality have been discarded...With the liberation of musical material, there arose the possibility of mastering it technically. It is as if music had thrown off that last alleged force of nature which its subject matter exercises upon it, and would now be able to assume command over this subject matter freely, consciously, and openly. (Ibid.: 52)

There is no longer a need then for the justification of the musical system upon ideologies based on concepts of "nature." The materials of Western music have become thoroughly "disenchanted." Their "magical essence" was first reduced by Rameau and others to a set of scientifically "discovered" and mathematically defined relations. In casting off the constraining force of these "natural laws" (this "veil of ideas"), musical materials are further reduced by Schoenberg and his followers: they become the completely objectified "raw materials" of a totalizing form of musical logic. The result is a kind of "mastery" over the tonal materials never before

achieved in Western music--it is in this sense that Adorno's notion of the musical domination of nature should be understood.

The development of the theory of tonality in Western music was distinct from, though closely related to, the practical problems of tuning musical instruments, especially keyboard instruments. I have already compared Rameau's theory of harmony to the concept of "scientific rationalization" and would now like to develop this comparison further with a discussion of instrumental construction and tuning as aspects of "technological rationalization." The interaction between these two forms of rationalism is complex and is again related to the idea of domination of nature.

The development of keyboard instruments in the West, especially the expansion of their range from a little more than three octaves to one of over seven octaves, brought the problems of tuning and temperament to a qualitatively different level than that encountered in other cultures. The tuning of instruments can also affect the tone system as a whole and for this reason the problems of tuning and temperament occupy a position of prominence in Weber's study of musical rationalization.

The history of the development of keyboard instruments begins with the invention of the organ, which has existed in rudimentary form since at least the second century B.C. (Weber, 1958c: 112). During the Middle Ages the organ became firmly established in monasteries and, later, in churches throughout Europe. Weber states that during the latter part of this period the development of the organ was important, through its role as an accompanying instrument, in the evolution of polyvocal music. Thus, the development of technology can have an influence on a very general, seemingly unrelated level of musical practice (Ibid.: 113-14).

After the thirteenth century, the demand for organs required that the responsibility for their manufacture be taken out of the context of the monasteries; at this point, "organ-building and with it to a considerable degree the practical leadership in development of the tone system lay in the hands of professional secular organ-builders" (Ibid.: 115). Here, Weber makes an explicit link between the practical, technological level of musical rationalization and the more "scientific" level of musical theory.

The period of experimentation with clavecin-type keyboards during the sixteenth century was mentioned during the previous chapter. The aim of these experiments was to arrive at a way of tuning keyboards that would allow them to be played in more than one key. Various tunings were proposed and used in practice throughout this period. The work of Marin Mersenne, although appearing at a rather late stage in this period of experimentation, perhaps offers an example of the problems and contradictions encountered in the development of keyboard tuning systems.

Mersenne (1588-1648) was a contemporary of both Francis Bacon and Descartes and, like them, was a tireless advocate of scientific philosophy in the seventeenth century (Leiss, 1972: 74-75). He also had an interest in musical theory and the natural overtone series:

Seeing the series go beyond the "major" triad, he proposed the inclusion of 7 as an integral musical resource, calling 7/6 consonant--the first such pronouncement regarding a ratio of 7--and designed many keyboards with greater resources than the already common 7-White-5-Black. (Partch, 1974: 382)

Partch's statement points to a fundamental problem however: the natural seventh harmonic cannot be easily "rationalized" into the tuning system

without either restricting the possibilities for modulation or without necessitating the addition of many more keys within the compass of the octave on the keyboard (the addition of more keys poses physical and practical problems with respect to the size of the human hand and the ability to deal with a large number of pitches within a single octave--thus restricting the development of keyboard virtuosity).

Mersenne's calculation of the mathematical basis of equal temperament (mentioned in Chapter One as  $\sqrt[12]{2}$ ) was to have more far reaching consequences than his proposal concerning seventh harmonic. For thus calculated, the system of equal temperament was placed on a firm theoretical and mathematical basis (it may have already been achieved in practice but was not yet widely used). Equal temperament is a system of tuning whereby all intervals smaller than the octave are adjusted such that the interval between any two adjacent tones is exactly the same. This means that the fundamental intervals of tonality--the third and the fifth--are actually somewhat out of tune with the natural overtone series. Other intervals, such as those associated with the seventh overtone, are so out of tune that they bear little resemblance to their "natural" counterparts.

While equal temperament cannot be justified on "natural" grounds, it does allow for greater freedom in modulation between keys. The origin of this desire for greater freedom in modulation is related to the development of the tonal system as a whole and is outside the scope of this paper.

All that need be pointed out here is that such desires are cultural and historical and that they create certain pressures on the development of musical technology. The direction taken by technological development is only partly related to scientific rationalization (Mersenne's discoveries point in opposite directions, they are mutually exclusive) and must also

respond to such musical pressures in much the same way that technological development at large responds to social and economic pressures. With the adoption of equal temperament, the "productive force" of the mature tonal system was released.

Equal temperament is rational firstly, because it is an orderly system of tuning derived from methodical experimentation and mathematical calculation and, secondly, because its adoption as a universal standard in Western music stems from its proven "efficiency" in achieving certain pre-determined musical ends. In a sense, it can also be considered as a form of musical domination of nature in that it attempts, in a direct and material way, "to 'grasp' and to place all sounds into an order." Our musical culture has adopted equal temperament and it has rejected the seventh and all higher overtones; thus it is clear that what we learn from science and mathematics is "how to adapt the environment to our needs culturally rather than adapting ourselves to external nature" (Habermas, 1970: 115).

Rameau was an advocate of equal temperament and with regard to this his musical theory is contradictory and, perhaps, ideological: Rameau posits natural science as a basis for a system of music and, in the process, masks all the inconvenient "facts" of nature (the 7th and higher overtones, tuning discrepancies etc.). The point is not that the equal tempered system of tuning or the theory of tonality are "unnatural"--all musical systems are cultural and historical; the point is that through such ideologies the system of tonality has come to be understood as "natural" rather than as a product of culture.

As noted earlier, in a quotation from Adorno, Schoenberg's twelve-tone method throws off this ideology of "natural laws." It takes the

tempered system at face value: it proposes an arbitrary system of compositional order in which all tones are considered as "equal" (i.e., not bound to the "hierarchical" power of the tonic), thus reflecting the arbitrary, mathematical equality found in the tuning system itself.

Without the prior development of equally tempered keyboard instruments, the twelve-tone method of composition would be inconceivable; a form of technological rationalization (temperament) begins to assume the role of nature itself and becomes the basis of a new scientific rationalism (the twelve tone system). With regard to this, Schoenberg's method is in no way dishonest—it proposes no "self-evident principle" or other ideology—but neither does it totally escape the system it has inherited. Instead, Schoenberg's method turns music into a reflection of its own technical means.

Adorno interprets Schoenberg's method of composition as being homologous to the social order as a whole. He describes Schoenberg's music as "an unreconciled picture of reality...The technical procedures of composition...objectively make music into a picture of repressive society" (Adorno, 1973:, 113). Adorno bases his interpretation on a formal conception of the "work" which privileges the relationship of the "part" to the "whole" and regards it as a kind of objective representation of the individual and his/her relationship to society. The achievement of "total organization" in Schoenberg's compositional method comes to be regarded as both a revelation of the dynamics of society and the basis of a social critique. Even if one accepts the manner in which Adorno leads from one level of order (the musical) to the other (the social), there are problems in the way that he interprets Schoenberg's music that I would like to examine.

Adorno's interpretation of Schoenberg's method of composition relies heavily on the ability of the method to control pitch structures (melody and harmony). In this respect Schoenberg's music is certainly much more highly rationalized than music of the earlier tonal period. But even taking into account Schoenberg's innovations in other areas of composition (such as the idea of "Klangfarbenmelodie") there are aspects of his music --his use of dynamics, rhythm and metre--that do not come under the control exerted by the twelve-tone method. Indeed, these other elements are used much more freely and in a relatively conventional manner. One of the reasons for this may be that not only had Schoenberg inherited the equal-tempered instruments of Western tradition but he had also inherited its system of notation. In conventional notation the specification of pitch and rhythm can be relatively precise (especially when the notion of "pitch" is restricted to only twelve tones without any subtle alterations, inflections or shadings of the tones); other aspects of music, such as dynamics, accelerando/ralentando, articulation, etc., cannot be controlled (at least in terms of actual performance) with anywhere near the same degree of precision. Musical notation "is not a unitary system but comprises incomplete subsystems" (Chanan, 1981: 236); "total organization" of the elements of music then is, almost by definition, impossible.

Given these facts, it is difficult to agree with Adorno's claim that in Schoenberg's music "all dimensions are developed to an equal degree" (Adorno, 1973: 53). Thus there may be some grounds for challenging Adorno's theory of the "totalizing" administrative structure of society while remaining perfectly within the framework of his own interpretive methods. For if the technical means for structural control of the "work"



are called into question as they have been above, then one might also wish to question whether the technical and institutional structures of society represent a "unitary system" or, as with notation, a set of "incomplete subsystems."

There is another problem with Adorno's interpretation of Schoenberg's music that is related to notation. In an essay entitled, "Musical Writing, Musical Speaking" (1977), Trevor Wishart examines the relationship between notated and performed music. Wishart states that our experience of music occurs in time which, according to Bergson, is a "unidirectional continuum," and is therefore subject to the actions and limitations of memory. In the score however, the musical work exists as a whole in a "timeless, spatialized, present" which can be organized, or analyzed, at any rate and in any order. Furthermore, spatialized time is "reversible." The "retrograde" version of Schoenberg's twelve-tone row (or the retrograde melodies and rhythms of early polyphonic music) is the formal manifestation of the possibility of spatial reversibility, of time resulting from musical notation. His understanding of the opposition between musical, experiential time and spatialized, notated time allows Wishart to formulate a question that has some importance to music theory and analysis: "This, of course, begs the central question of what constitutes music, what we experience in the sounds, or what we might theoretically appreciate of the score" (Wishart, 1977: 141).

Adorno's assessment of Schoenberg's work rests almost entirely on the basis of the unifying aspects of the notational structure and not on the sounding music. Wishart indicates that there is another level of structure operating in Schoenberg's work. He gives examples of certain thematic ideas (he calls them "gestalts") that tend to retain the same

melodic and rhythmic character irregardless of the permutation of the row in use (to be fair, Adorno was also aware of the thematic elements of Schoenberg's work, and it is this aspect of his music that sets it apart from the "fetishized" use of the row discussed earlier). The important point to be noted is that this thematic level of structure is audible and contributes to the meaning of the music as heard. Wishart's question can perhaps be reformulated: Does the unity of the work of art (and its supposed relationship to the structural totality of society) exist in its compositional method as revealed through notation, or in the experience of the music as heard?<sup>1</sup>

In Schoenberg's day of course, to be heard, notated music still had to first be performed in some way and it is to the relationship between the composer and the performer, as mediated by the notated score, that I would now like to turn. Earlier in this chapter, I described the specific framework in which Adorno's notion of the musical domination of nature might be understood. At this point I would like to introduce the other half of the equation-- the domination of man--with regard to a particular historical interpretation of the relationship between the composer and the performer. My argument is not concerned with any incidental, direct manifestations of power or domination between these two partners in the musical enterprise; but rather, my interest lies in how, at specific moments in history, their relationship comes to be defined by a shifting set of responsibilities to the musical score.

In Weber's essay on music the development of a relatively precise form of notation is regarded as a key factor in the rationalization of

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<sup>1</sup>To raise the question of the work as heard is also to raise the question of the role of the listener in the construction of musical meaning; to pursue this question further would go beyond the scope of this thesis.

Western music. Weber points out that a number of musical cultures around the world have had some form of rudimentary musical notation. This type of notation is often relatively imprecise and in traditional music making it is used mainly as a mnemonic device. But in the West, notation not only develops a higher degree of precision than that found in other cultures, it also becomes an essential means for organizing complex musical compositions:

even today, in principle, the pure linguistic rhythmic work could be thought of as existing quite independently of orthography. A somewhat complicated modern work of music, on the other hand, is neither producible nor transmittable nor reproducible without the use of notation. It cannot exist anywhere and in any form at all, not even as an intimate possession of its creator. (Weber, 1958c: 84)

One of Weber's main arguments is that Western notation and polyvocal music are intimately bound in a relationship of mutual reinforcement--each contributing to the development of the other and to the overall rationalization of the musical system. I do not intend to go into detail here concerning Weber's account of this development. Instead, I would like to place selective emphasis on a few isolated comments that appear almost like asides in the context of Weber's main historical overview of the subject.

At a very early stage of its development Western notation was essentially "descriptive,"<sup>1</sup> that is, it attempted to capture certain aspects of traditional and ecclesiastical music as an aid to its retention in the singer's memory. The Medieval system of "neumes," as they were called, left much to be desired however:

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<sup>1</sup>The terms "descriptive" and "prescriptive" used here are those of musicologist Charles Seeger.

In particular the neumes did not differentiate between whole and semitone steps. This circumstance favored flexibility of official musical patterns...and favored the penetration of popular tonal traditions into musical development. As early as the ninth century, because of this unorderliness, the improvement of a notation had become an object of eager speculation by monastic musical scholars. (Ibid.: 86)

Later, Weber points out that a similar problem existed in controlling the manner in which singers improvised ornaments to the melodic line in church music; he states that the first real improvements brought about in the notational system by Guido d'Arezzo (ca. 990-1050) were specifically intended to remedy the problem of ambiguity in the neumes. What is striking here is the fact that greater precision in the notational system is not pursued for purely musical purposes but also as a means for church authorities to suppress secular musical practices and as a means of control over musical improvisation which was, at the time, still considered as one of the rights and responsibilities of singers.

Even at this early stage then, notation has started to become "prescriptive," that is, it is regarded as a set of more or less rigid instructions for performance. As already noted in Chapter One, notation created the specialized roles of the composer and the performer. However, even as complex polyvocal music developed via notation (Weber cites the importance of the development of relative time values in notation as contributing to the ability of composers to rationally plan many-voiced compositions; Ibid.: 87-88), improvisation still played a legitimate role in musical practice: "Even up to the end of the seventeenth century...The papal band required of all applicants the ability to improvise counterpoint" (Ibid.: 88).

During the Baroque period improvisation and ornamentation were still an important part of the performer's responsibilities. Opportunities for

improvisation were incorporated as an integral part of the score in the form of ornaments, figured bass, extended cadences, etc. "But it's important to state quite clearly what made this possible, namely, established patterns of social decorum and deference like those which were to be found in court life itself" (Chanan, 1981: 227). The interpretation of the score was thus governed by a set of social norms, a recognized hierarchy between composer and performer.

All this began to change however at the beginning of the bourgeois era. In the third chapter of his book Bruits, Jacques Attali describes the struggle of the composer to free himself from his position as a domestic servant in the royal courts of Europe. The notated score played a crucial role in this struggle and in the transition from a feudal to a market economy:

Pour que la musique s'institutionnalise en marchandise, pour qu'elle prenne son statut autonome et acquiere une valeur en monnaie de la musique, une valeur du travail de création et d'interprétation musicale. Il fallait ensuite, ce qui fut beaucoup plus tardif, que soit distinguée la valeur de l'oeuvre de celle de sa représentation, la valeur du programme et celle de son usage.

Cette valorisation de la musique s'est construite contre tout le système féodal, pour qui l'oeuvre, propriété absolue du seigneur, n'avait pas d'existence autonome. Elle s'est construite sur l'existence concrète d'une valorisation marchande possible dans un objet, la partition, et dans son usage, la représentation. (Attali, 1977: 103-104)

Within the capitalist context the relationship between the composer and the performer is mediated by both the score and the market economy that it represents. The title of "authorship" becomes a critical aspect of the composer's claim to remuneration and, with regard to this claim, the role of the performer must be clearly defined as non-productive. At the same time, the old social norms that governed improvisation have been

eroded along with the social and economic system upon which they were based. By the end of the eighteenth century improvisation has virtually disappeared as an integral part of musical practice and this is reflected in the score itself: ornaments tend to be precisely notated, chordal accompaniments are filled in, cadenzas in solo sonatas are written out by the composer (in some concerti the virtuoso soloist is still allowed to improvise his own cadenza but even this practice becomes less prevalent as the century progresses) etc. "Improvements" in notation have also been introduced: dynamics, crescendo/decrescendo and, with the invention of the metronome, tempo markings reach a previously unknown degree of specificity.

What I would like to argue here is that every increase in the specificity of notational art can be understood as part of a process by which the composer gains mastery over the technical materials of music, but it must also be understood that such mastery is gained indirectly--it is gained through a simultaneous mastery over the role played by the performer in the presentation of music. This mastery (or "domination") of the performer depends on a specialized musical training and "discipline" that prescribes the limits of "interpretation" (such limits are seldom rigid or absolute however).

Of course, the performer participates in all of this. With every new demand placed on the performer s/he responds with ever greater levels of mastery over the art of performance--s/he becomes the "virtuoso." But this virtuosity is of an entirely different nature from that of the improvising musician. Whereas the liberties taken by the improvising musician elaborate and contribute to the structure of the work, the relatively limited range of liberties taken by the virtuoso interpreter "cease to carry structural significance within the music because structural signifi-

cance is granted only by what the notation renders articulate" (Chanan, 1981: 236). The reverence accorded to the virtuoso performer by the audience—who follows the interpreter's every hesitation and subtle nuance with rapt attention—stands in direct opposition to the lack of interest exhibited by musical theory and analysis in matters of interpretation (such matters are usually the concern of historians and performers only).

The advent of sound recording marks the beginning of a new era in the shifting relationship between the performer and the composer. For with recording the interpretation of a work takes on an "autonomy" of its own. The recording of a specific interpretation becomes an object of exchange value just as the score had once been the autonomous bearer of the "work" in the previous stage of capital. The specific interpretation (and the interpreter) achieves a degree of "immortality" that was formerly accorded only to the work itself (and the composer). The recording career of Enrico Caruso at the turn of the century marks this change in status of the performer.

A performance that is fixed on record is exactly repeatable and is therefore made available for analysis and comparison with other recorded performances. The importance given to interpretations of known works is one of the complex factors that has contributed to the estrangement of performers from contemporary music and their almost exclusive concentration on the music of the past:

We ought to note that not only is there a focus on the past, but even on the past in the past, as far as the performer is concerned. And this is of course how one attains ecstasy while listening to the interpretation of a certain classical work by a performer who disappeared decades ago...One sees a pseudo-culture of documentation taking shape, based on the exquisite hour and fugitive moment, which reminds us at once of the fragility and of

the durability of the performer become immortal, rivalling now the immortality of the masterpiece...what more could you want as an alibi for reproduction as opposed to real production? (Pierre Boulez in Foucault and Boulez, 1985: 9)

Recording can also influence musical practice in a more direct way in that it can rationalize the manner in which the performer arrives at a particular interpretation of a work. Sound recordings create a kind of historical precedent upon which comparisons can be made; in this way the recording becomes a means, the basis of a comparative method for judging the effectiveness of one or more interpretations of a work. It is not uncommon today for performers and conductors to make use of recordings in this way.

Though it is seldom acknowledged, recordings have had a powerful impact on the relationship between the performer and the composer and on the general manner in which art music is currently taught and practiced in the West. Rather than pursue this further however I would like to take it up again below in relation to another form of music--popular music--where recording has become an indispensable part of musical production.

#### Popular Music in the Early Twentieth Century

Earlier in this chapter it was noted that Weber regarded "irrational," chromatic melodicism as one of the most expressive aspects of Western art music precisely because it existed in continuous tension with rational, harmonic structure. Throughout his study of music Weber was careful to point out such tensions, contradictions, and balances between rational and irrational elements of music. While he made no specific study of Western folk or popular music, he carried the same concern for the balance between the rational and the irrational into his analyses of non-Western musical



systems and one would expect that his approach to the study of popular music would have been similar.

As in his study of the music of Schoenberg, Adorno analyzes popular music in relation to social structure and the notion of "total bureaucracy." While Adorno's work can be insightful it also tends to be too general and ignores many basic contradictions in both musical practice and in society. Furthermore, his musical criticisms are based on a relatively narrow European view of music that is often inappropriate to the musical practice under consideration. Much of what follows attempts to trace out the balance between certain rational and irrational elements in popular music during the early twentieth century and, in doing so, will also present a critique of some of Adorno's ideas and assumptions.

One reason for adopting Weber's approach rather than Adorno's is that much popular music of the twentieth century, such as jazz, is made up of hybrid forms that have developed from a variety of sources--Western and non-Western; the breadth of Weber's study thus offers a better perspective from which to understand various aspects of popular music. It has been suggested that the evolution of jazz during the past century resembles, in highly compressed form, developments in the history of Western music that took five centuries to accomplish (Hobart, 1981: 261). In keeping with Weber's thesis, the evolution of jazz could be interpreted in terms of its developing rationalization. While there are certain aspects of jazz history that will be discussed briefly below that would support this line of reasoning, it is also necessary to consider those aspects of jazz that make it a hybrid form and thus contribute to a very different balance between rational and irrational structures than that found in Western music as a whole.

Jazz, primarily an instrumental form of music, developed out of an earlier sung form--the blues. So despite its use of Western instruments and chord structures, early jazz was perhaps closer to a vocal, melodically based music than to Western concepts of harmony. As mentioned in the first part of this chapter, Weber made a clear distinction between musical scales and intervals derived from melodic concepts and those derived from harmonic thinking. The latter is reflected in Adorno's interpretation of the melodic inflections of jazz; "It is a well-known fact that in daring jazz arrangements worried notes, dirty tones, in other words, false notes, play a conspicuous role. They are apperceived as exciting stimuli only because they are corrected by the ear to the right note" (Adorno, 1941: 26). Here Adorno displays the bias of his training in Western classical music by insisting on interpreting these "false notes" in terms of the diatonic scale. But if the origins of jazz are not to be found solely within the European tradition then another way of accounting for these intervals must be found. For as Weber pointed out: "an ear which, unlike ours, does not, by training unconsciously interpret each interval born out of pure melodic and expressive needs in harmonic terms, is not restricted to the enjoyment of intervals which it can classify harmonically" (Weber, 1958c: 93).

In his study of the origins and development of Black music in America LeRoi Jones posits the existence of a musical scale of African origin as the tonal basis of early blues. He cites the work of Sidney Finkelstein in support of his claim: "these deviations from the pitch familiar to concert music are not, of course, the result of an inability to sing or play in tune. They mean that the blues are a non-diatonic music" (Jones, 1963: 25). In analyzing the popular music of America Adorno made the

mistake of attempting to define one of its most salient characteristics in terms of another, quite different musical system.

It follows then that the mere presence of Western chordal structures in Afro-American music does not necessarily indicate a high level of rationalization. The blues evolved from the "shout" as a purely vocal form before the introduction of chordal accompaniment and the twelve bar structure. The twelve-bar blues is itself very unlike most traditional Western uses of harmony in that it makes use of three dominant seventh chords (on the tonic, sub-dominant and the dominant) and thus cannot achieve a truly satisfactory cadence on the tonic. The use of these chords has probably less to do with the rational organization of tones than with rhythmic articulation and the definition of a larger structural frame (i.e., the verse).

The early New Orleans jazz bands combined the blues with other influences from Europe (such as the music and instruments of the Napoleonic military bands) and certainly became more familiar with Western harmonic structure. But the tendency to have all band members improvise perhaps prevented such structuring from having too great a rationalizing effect on the music. According to Jones, in the pre-swing jazz of bands like Buddy Bolden one might find "all the players improvising simultaneously" in a kind of African derived vocal polyphony. The African vocal style was characterized by a much more developed use of timbre than that found in Western music. The use of subtle timbral shadings, pitch inflection, rhythmic syncopation, etc., in a free polyphonic style all contributed to an "affective" (in Weber's sense of the term) form of music that had little in common with Western rationalism. The following passage written by French composer Darius Milhaud after his first encounters with jazz

in 1918 attests to how foreign these "irrational" aspects of jazz were to the Western ear:

The new music was extremely subtle in its use of timbre; the saxophone breaking in, squeezing out the juice of dreams, or the trumpet, dramatic or languorous by turns, the clarinet, frequently played in its upper register, the lyrical use of the trombone, glancing with its slide over quarter-tones in crescendos of volume and pitch, thus intensifying the feeling; and the whole so various yet not disparate, held together by the piano and subtly punctuated by the complex rhythms of the percussion...I had the idea of using these timbres and rhythms in a work of chamber music, but first I had to penetrate more deeply into the arcana of this new musical form, whose technique still baffled me. (Milhaud, 1967: 35-36).

There was nothing formalized about the use of timbre in early jazz: ensemble groupings were not yet standardized and the expressive use of instrumental tone was not circumscribed by formal rules of playing technique (which strive for an evenness and homogeneity of tone) as in classical music.

In considering the use of musical instruments it might be worthwhile recalling Raymond Williams' ideas concerning technology and social practice mentioned briefly in Chapter One. If we consider musical instruments as more than the instruments themselves but also a set of formalized techniques and aesthetic preferences as regards tone production, then it is clear that jazz, and indeed most folk and popular musics, have devised their own uses and practices for the instruments that they have adopted. From the point of view of the trained classical performer such uses may appear to be little more than the result of "improper" or "inadequate" training. To a certain extent this is true but, as in the case of jazz and its use of pitch and timbral inflection noted above, these playing techniques may develop intentionally in response to different musical and social needs.

Some instruments may be less adaptable to new needs than others and the piano is perhaps a case in point. According to LeRoi Jones, "the piano was one of the last instruments to be mastered by Negro performers" (1963: 90) and the most well-known style of early Black music associated with it--ragtime--is perhaps the least characteristic of Black music overall:

It was a composed music--going that far toward the European, or "legitimate," concept of musical performance. It was perhaps the most instrumental, or more precisely, the most pianistic, of any Negro music...I mention ragtime here because it seems to me important to consider what kind of music resulted when the Negro abandoned too much of his own musical tradition in favor of a more formalized, less spontaneous concept of music. (Ibid.)

The effect on the music described here by Jones is partly the result of the adoption of an instrument, along with a specific set of instrumental techniques, and partly the result of the introduction of strict notation. Ragtime was primarily a solo instrumental style but it was still influential when the piano began to be used in early jazz ensembles. Jones notes that bands like King Oliver's Creole Band had a smoother style than that of earlier bands like Bolden's; Oliver's band "showed a discipline and formality that must certainly have been imposed to a large degree by ragtime and the more precise pianistic techniques that went with it" (Ibid.: 146).

By the 1920's jazz had not only incorporated the use of the piano but was also becoming a more composed (or at least arranged) musical form. Larger instrumental forces became common and, as in the symphony orchestra, a rational division of the jazz band slowly emerged, eventually developing into a grouping of semi-autonomous ensembles: the rhythm section, saxo-

phone and trumpet sections, etc. Collective improvisation gave way to big dance band arrangements fronted by hot soloists—Fletcher Henderson's Roseland band with Louis Armstrong as soloist led the way here towards what would eventually develop into a new White form of jazz: "swing" (Ibid.: 155-156; the appearance of swing will be taken up again below).

The big band style tended to confine improvisation within rational chordal and metric schemes. Even though Bebop moved jazz beyond the confines of the big band form it could not escape an increasing dependence on harmonic structure: "even the fresh uses to which the boppers put riff-based chords have been exploited and re-exploited to staleness. The hard boppers, if anything, increased to an even greater degree the improvising jazz musician's reliance on 'changes'" (Ibid.: 226). By the late fifties and early sixties jazz had developed its own versions of modernism: pan-tonality, atonality, and even some limited use of the twelve-tone row.

Throughout this development of increasing rationalization in jazz there remains one constant element that maintains the tension between the irrational and the rational: improvisation. Parallel to this, and partly as a result of it, jazz has always remained a performer's art—the clear separation and specialization of composer, arranger, and performer has never really taken hold. For the same reason, notation (except in the instances mentioned above) has not tended to become overly precise in its detail, it remains a schematic outline of the composition. The balance in jazz (at least until the sixties) between rational and irrational always leans somewhat towards the expressive or the "affective":

[Cecil] Taylor and [Ornette] Coleman know the music of Anton Webern and are responsible to it intellectually, as they would be to any stimulating art form. But they are not responsible to it emotionally...The emotional

significance of most Negro music has been its separation from the emotional and philosophical attitudes of classical music. In order for the jazz musician to utilize most expressively any formal classical techniques, it is certainly necessary that these techniques be subjected to the emotional and philosophical attitudes of Afro-American music. (Ibid.: 229-230)

What separates Black jazz from Western philosophical attitudes is its consciousness of its own musical, racial, and cultural heritage. In his book, Jones points out that while jazz changed and incorporated various European techniques during its history, it also constantly re-assessed its own musical traditions based in melodic and timbral vocal styles, and rhythm. In this way, changes in jazz form occurred through a process of renewal as much as through a Western notion of "progress" (in Adorno's sense of the term). In Weber's typology, jazz could be said to have struck a balance between its own "traditional" forms, a spontaneous, "affective" expressivity, and Western "rational" structures.

In contrast to jazz, the tensions between rational and irrational (especially with regards to harmony and melody) in popular songs of the Tin Pan Alley era are more typically Western in character. A casual glance through sheet music of the period reveals a prolific use of chromatic tones in melody set against relatively conventional harmonic arrangements: the raised supertonic used as a secondary leading tone to the third of the tonic chord is perhaps a characteristic device.<sup>1</sup> The bitter-sweet quality of this music is due, in part, to such melodic devices. Unlike jazz, however, whose melodic inflection is derived from a different, much freer attitude towards the notes of the scale, the

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<sup>1</sup> These observations are based on a "glance" through a number of songs of the period; no systematic research was undertaken.

chromaticism of Tin Pan Alley is not fundamentally different from that found in Western classical music since the time of Mozart.

Adorno argues however that the appearance of such devices in popular music is different from their use in "serious" music--"serious" music produces a unity between the detail and the whole, whereas "popular" music is fragmented and there exists no relationship between detail and overall framework. Adorno states that the commercialization of popular music has led to an unprecedented level of "standardization"--"the sum total of all the conventions and material formulas in music to which [the listener] is accustomed" (Adorno, 1941: 24). Standardization is concerned with the local effect of detail and therefore cannot achieve a sense of totality.<sup>1</sup> Even the improvised melodic flights of the jazz musician have become standardized: "Improvisations...are confined within the walls of the harmonic and metric scheme...improvised detail is completely determined... standardization of the norm enhances in a purely technical way standardization of its own deviation--pseudo-individualization" (Ibid.: 25). Thus, for Adorno, popular music disguises its own musical framework and, by analogy, masks the administrative structure of society and its control over the individual.

There is certainly a grain of truth in much of what Adorno says of popular music (or at least certain varieties of it) but he tends to inval-

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<sup>1</sup>The other half of Adorno's argument is that "Structural standardization aims at standard reactions" (Ibid.: 21); that there exists a kind of "psychological transfer" where the gratification of ownership is transferred to the object of consumption (Ibid. 36). In as much as this part of his argument and that concerning the function of music as "social cement" is concerned with the listener, I will not elaborate or critique this aspect of his work here. An interesting counter-argument to Adorno's view of the listener can be found in Riesman, 1957.



idate many of his own arguments through the sheer extravagance of his claims and the lack of precision with which he ~~uses~~ the terms "popular music," "Tin Pan Alley," "swing," and "jazz." Indeed, with Adorno none of these categories of music appear to have any identity of its own; he uses the terms quite indiscriminately. In fact, it is quite unlikely that Adorno was very familiar, if at all, with the jazz of Black Americans. In his writing he concerns himself primarily with commercial swing as heard on radio and mentions only White swing bands, like those of Goodman and Whiteman, and "sweet" bands, like that of Guy Lombardo.

It is perhaps worthwhile to critique some of Adorno's ideas here if only because issues relating to musical detail, improvisation, and structure will become relevant later in the discussion of multitrack recording practices; it seems to me that some flexibility as regards the interpretation of different musical practices is necessary in such an undertaking. Firstly, Adorno's criticism of improvisation as "pseudo-individualization" disregards the fact that jazz music of this period was not an "autonomous" form; but rather, it also functioned as a form of dance music and was therefore dependent upon certain kinds of structure, especially metric structure. Such a dependency does not, in itself, invalidate the spontaneous, creative elaboration of those structures. Of course, it makes a difference whether one is comparing this type of "improvisation" to the Baroque practices of ornamentation and figured-bass realization, improvisation of cadenzas in Classical concerti, or improvisation in Indian raga. Such comparisons themselves may be irrelevant but at least they can help define the terms of an argument. The problem with Adorno is that he offers no model by which we might understand exactly what he means by "improvisation" nor does he describe the conditions under which improvisation could be considered meaningful in popular music.

What may also be at issue here is Adorno's emphasis on the formal structure of music and his notion of "progress." Kurt Weill, for example, viewed music from a completely different position. He felt that the importance of jazz for classical composition lay precisely in the manner in which it allowed for a "relaxation" of form (no doubt Adorno would regard this as an aspect of musical "regression"). But not only composition is of importance here:

it appears to me that the manner of performance of jazz is finally breaking through the rigid system of musical practice in our concerts and theaters and that this is more important than its influence on musical composition...A good jazz musician completely masters three or four instruments; he plays from memory; he is accustomed to the art of ensemble playing, in which each player contributes individually to the collective sound. But, above all, he can improvise; he cultivates a free, unrestrained style of playing in which the interpreter achieves to the highest degree a productive performance. The extent to which all this can be applied to art music naturally depends primarily on the musical product itself, which certainly does not always allow such freedom of interpretation. (Weill, 1979: 497)

The ways in which performance can be considered as a "productive" practice are of considerable importance in the study of popular music. In his work overall, Adorno displays an inadequate conception of performance practice.

Adorno also tends to confuse American popular music with its European counterpart: "the division into the two spheres of music ["serious" and "popular"] took place in Europe long before American popular music arose. American music from its inception accepted the division as something pre-given" (Adorno, 1941: 17). This may not be historically accurate nor does it reflect the real complexity of the American context. In an article entitled, "Music and Class Structure in the United States" (1957), American musicologist, Charles Seeger, describes how during the nineteenth

century two competing pressure groups (one advocating the standards of European art music, the other representing the interests of an urban based commercial music industry) nearly succeeded in establishing a neo-European musical class structure in the United States. With some exceptions, both these groups tended to ignore the various forms of rural folk music (both White and Black) that existed outside urban centers.

By the end of the nineteenth century certain aspects of this division had already begun to break down, especially in music education. But, as Seeger points out, it was the phenomenal success of sound recording (and later radio) that was to be the "catalytic agent" in bringing about a "democratizing" of musical culture in the U.S. Not only were the two pressure groups mentioned above brought closer together but also the communications media (albeit for their own commercial reasons) contributed greatly to the dissemination of rural musics that had not previously been accepted by either of the urban pressure groups nor exploited by them as markets.

Seeger does not go into detail as to how these changes came about nor does he point out the various conflicts that developed within the music industry during this period--in fact, he tends to present the industry as being rather unified in its overall aims. The area of conflict I would like to discuss here is that between music publishing and the early recording and broadcast industries. In a sense, the conflict results from a difference between commodity forms--a difference between notation and mechanical (and electrical) reproduction--and different types of control.

During the late nineteenth and early twentieth centuries Tin Pan Alley developed around the production and sale of sheet music. It was

dependent on a large number of amateur musicians and the parlor piano as a central part of middle class entertainment in the home. Black music,<sup>1</sup> as well as rural folk musics of all kinds, were of little interest to this industry for two reasons: firstly, the subtle nuances of these performed musics could not be notated accurately and, secondly, the Black and rural communities were not viewed as significant markets for either sheet music or pianos. The live performance of Tin Pan Alley songs by professional musicians was regarded mainly as a means of "plugging" the tunes that were to be sold in sheet form: "Songs were placed into musical stage reviews; children were coached to "spontaneously" sing a new song during lulls in vaudeville performances. Pluggers sang their wares in department stores, railroad stations, public parks, and anywhere else a crowd might gather"(Peterson and Berger, 1972: 286).

The role of notation in the specialization of functions in popular music production was mentioned briefly in Chapter One. But as Tin Pan Alley made its adjustment to the new technologies of records and radio, notation also became a means of controlling performance. The "standardization" of popular songs (both with respect to their form and in the manner of their performance) described by Adorno is perhaps the result of the rationalized (and dominated) production of music which was still undertaken primarily in the interest of selling a particular commodity to a particular market--notated songs for amateur musicians:

The products of the publishing industry necessarily had to be within the technical competence of the amateur performers who constituted the mass market...It was in the publisher's interest that performance should emphasize

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<sup>1</sup>As already mentioned, the only possible exception to this was perhaps ragtime, which was a notated music.

the aesthetic quality of a written melody, rather than the technical skill of the performance...Hence there was a pressure towards the standardization of performances of particular songs, which was achieved through the practice of bands using standard arrangements, from which the publishers also profited. (Hobart, 1981: 271)

Thus elaborate improvisation, ornamentation, or even an overly personalized rendition of the melody might be discouraged by the publisher:

"The most valuable attribute of a musician's skill 'vis-à-vis' publishing was their ability to reproduce a songsheet accurately" (Ibid.).

The constraints placed on the professional musician via notation in popular music were not unlike those placed on interpreters in classical music as described in the previous section of this chapter. But whereas in classical music it was in the interest of the composer to control performance of the work in order to protect his right (artistic and financial) of authorship, in Tin Pan Alley pop, domination of the performer is carried out in the interests of large-scale capital:

until musical production is mechanized, and mechanically reproduceable, capital cannot intervene at the point of production of music unless it is notated. The reliance on notation...is a precondition for the development of large-scale capitalist relations to develop in the sphere of production. The musician who can only produce music from manuscript is necessarily dependent on the providers of manuscript. (Ibid.)

Hobart points out that for companies whose only interest is the sale of recordings, the uniqueness of an individual performer's style could be a strong asset. As mentioned earlier with respect to classical music, recording gave a new importance to the role of performance in music. Furthermore, recording (and later, radio) opened up the possibility of exploiting new markets that had been largely untouched by publishers.

After the First World War and throughout the 1920's blues, jazz, country and folk musics were recorded (country was also later broadcast on radio in the rural southern U.S. but Black musicians and bands were generally discriminated against by radio during this period). Many of the smaller record companies survived the initial, industry-wide downturn in record sales brought on by the popularity of radio during the early 1920's precisely because of their relationship to specialized markets. It was the early Depression years that destroyed many of these companies along with much of the rest of the recording industry.

Adorno's criticism of popular music of the 1930's should perhaps be seen in light of the various factors which I have outlined above. His perception of popular music attests to the predominance of Tin Pan Alley and White swing (the two popular forms most closely related to the interests of traditional publishing and notated arrangements) on mainstream radio of the 1930's. Ironically, at precisely the time that Adorno was writing his criticism (during the late 1930's and early 1940's) the juke box industry, and the general easing of Depression poverty, were contributing to an upturn in the fortunes of the recording industry and a revival in the production and popularity of "race" and "hillbilly" music (of course, it is unlikely that any of this would have changed Adorno's view of popular music).

The ASCAP/BMI conflicts between 1939 and 1941 have been cited by Hobart (and others) as signaling the demise of the power of publishing in popular music production.<sup>1,2</sup> One of the effects of these conflicts was a

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<sup>1</sup>ASCAP, which had primarily looked after the royalty interests of Tin Pan Alley composers and publishers, demanded a 100% increase in fees from radio broadcasters. BMI was formed by the broadcasters in response to this challenge; it signed many jazz, blues and hillbilly musicians.

<sup>2</sup>Ewen situates the demise of Tin Pan Alley much earlier, at about 1930 (Ewen, 1957: 195-196).

wider distribution and appreciation for non-industrialized forms of popular music throughout the U.S. Certainly the new commodity form and the industry that promoted it placed their own constraints on performance: technically, the four minute duration of 78 r.p.m. records effectively prevented the freer, extended forms of jazz improvisation from being heard outside of nightclubs; and the record companies exerted considerable influence on Country and Western, and other folk forms, in an attempt to "polish" them for general consumption. Nevertheless, as both Charles Seeger and Mike Hobart have argued, the rise of the recording and broadcast industries, at least initially, can be seen to have had a liberating influence on popular, performed musics. Recent changes that have taken place in the technologically based conditions of production in the recording industry will be the topic of Chapter Four of the thesis.

### Conclusion

In order to lay a groundwork for the study of technology and music that will be taken up in the following chapters, I have attempted to interpret certain aspects of music history and theory in terms of the notions of rationalization and domination; the ideas of Weber and Adorno have figured prominently throughout.

In classical music, Weber's idea of the polarity between irrational, expressive melodicism, and rational harmonic structure was examined. The ideas of the eighteenth-century composer and musical theorist, Jean-Philippe Rameau, were cited in support of Weber's claims and the compositional method of the early twentieth-century modernist, Arnold Schoenberg, was shown to have collapsed that polarity in favor of a rational, all-encompassing organization of tonal materials. Adorno's claim that Schoen-

berg's method constitutes a form of musical "domination of nature" led to a discussion of how a certain "scientific" concept of "natural" harmonic structure had developed in the West; again, Rameau's ideas were instrumental in the establishment of this concept. Adorno's exaggerated assessment of Schoenberg's method, and his leap from the analysis of musical structure to a more general analysis of social structure was rejected in favor of an examination of the tuning of musical instruments and the development of notation as forms of "technological rationalization"; in addition, notation was considered in light of its role in the mastery over musical materials and over the musical/social relationship between the composer and the performer. Finally, the advent of sound recording was discussed briefly with respect to a possible shift in the balance of that relationship.

A similar set of concerns were taken up in relation to popular music of the early twentieth century. Weber's theory of rational and irrational elements in music was again reviewed in respect to jazz and its use of traditional, African-derived scale formations and expressive melodic devices in connection to its adoption of Western chordal structures and Western musical instruments. What appears as a trend towards increasing rationalization in jazz (in part due to the use of notation and larger instrumental ensembles) was discussed in relation to the role of improvisation in this hybrid musical form. Adorno's criticisms of American popular music and jazz improvisation were countered with Kurt Weill's notion of improvisation as "productive performance," and Charles Seeger's account of the "democratization" of music in America during the early twentieth century. Finally, Hobart's description of the constraining force of notation as a musical commodity form during the era of Tin Pan Alley pop and



the transition to a new popular music industry based in sound recording and broadcasting was presented.

In this chapter I have attempted to show how rationalization and domination can be understood with regards to musical materials and musical/social relations of the immediate, and not so immediate past. Electronic sound production in the music of the post-war avant-garde and the rise of multitrack recording in popular music of the late 1960's are often considered to be "revolutionary" developments in the history of music--claims of "liberation" of various sorts have accompanied both events. However, genuine revolutions are few and perhaps none have ever achieved a complete break with the past. Through historical reflection one can sometimes come to understand how it is that such events can present genuinely new possibilities and, at the same time, entrench old values, structures, and ideas (the case of Schoenberg's twelve-tone method is perhaps a good example--while he never seems to have made revolutionary claims for his method, many others have done so on his behalf, even claiming that Schoenberg did not realize the true revolutionary potential of the method). In regards to the thesis as a whole, the relevance of the historical interpretations presented in this chapter will become evident in those that follow.

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CHAPTER THREE  
SCIENCE, TECHNOLOGY,  
AND THE POST-WAR AVANT-GARDE

The restoration of avant-garde music after World War II coincided with the introduction and expansion of new instruments in the field of audio technology: the tape recorder, electronic sound generators and modifiers, and the computer (the development of the latter, of course, occurred outside the area of audio technology but was soon adopted for musical purposes). The combination of the renewed desire to make a clean break with the music of the past and the development of new technical means created a powerful movement within contemporary music. These events might appear as little more than a fortuitous coincidence were it not for the fact that electronic means of musical production had been consciously sought after throughout the first half of the twentieth century.

While the new technologies had not been specifically designed for the purpose of musical production (tape recorders were designed primarily for the storage and reproduction of sound; oscillators for the purposes of radio broadcasting), they soon became the object of a musical/technological rationalization; that is, the technical devices themselves and the practices that evolved for their use were purposefully organized in order to meet the specific aesthetic needs that had developed during the earlier period of modernism in music. Thus, a set of technologies originally developed for commercial and/or state interests was adapted by a

relatively marginal social group for its own purposes. Karlheinz Stockhausen summed up the move towards a more artistic use of the technology in this manner: "Electronic music no longer uses tape and loudspeakers for re-production, but for production" (Stockhausen, 1961: 64). Raymond Williams would perhaps agree that in the context of commercial sound reproduction and centralized broadcasting, the development of electronic music could be regarded as a positive musical act.

But while the new technical means allowed the musical avant-garde to move beyond certain constraints of traditional music (the old instruments, the tempered scale, tonal harmony, etc.), their use also tended to reinforce the growing rationalization that Weber had noted as characteristic of Western music. This increase in rationalization took two distinct forms in the early period of European electronic music. Firstly, in France, the school of electronic music known as "musique concrète" took on an empirical approach—methodical, quasi-scientific experimentation was its primary mode of operation. Secondly, in Germany, "elektronische musik," based in mathematical, formalized logic, developed around "serial" techniques of composition. The concept of the "series" extended the principles of Schoenberg's twelve-tone method of composition (especially as developed in the music of Anton Webern) to all aspects of musical material: not only to pitch structures, but also to rhythm, dynamics, articulation, register, timbre and density. The latter is of particular interest here: the degree of rationalization achieved during the important, albeit brief, period of European serialism during the 1950's has been referred to by Michael Chanan as "hyper-rationalization" (1981: 241; it is interesting to note that Chanan refers only to serial music written for traditional instruments and does not mention electronic music where,

as I will show later, the level of rationalization was even greater); similarly, Eric Salzman has referred to the period as one of "ultra-rationality" (1974: 145-151).

In the previous chapter I argued that Adorno's notion of "total organization" and the musical domination of nature as embodied in the twelve-tone method of composition was ill-founded, that the technological means available to Schoenberg and his followers did not support such a notion. With the advent of electronic technologies however, a much more definite and powerful trend towards not only technological rationalization but also the musical domination of nature can be observed. Again, in each of the two schools of electronic music mentioned above, domination takes on a distinctive form (the essential differences between the two forms of domination will be taken up in detail later).

The present chapter is concerned with the manner in which technology came to be employed in the interests of musical rationalization and domination. The first part of this chapter will be devoted to a discussion of various preoccupations of early twentieth century music that led, in some quarters, to the idea that musical "progress" was intimately tied to the acquisition of scientific knowledge and to technological innovation. In addition, a number of institutional factors relating to the rational character of electronic music during this period will be briefly addressed. The following sections will examine some of the aesthetic intentions and technical practices associated with "musique concrète" and "elektronische musik." The emphasis in this chapter will be heavily weighted in favor of the aesthetic and theoretical foundations of these two schools of composition. In part, this is due to the fact that the techniques of tape composition (editing, montage, etc.) were shared by both schools.

The studios however quite early on in the fifties differentiated themselves from one another in terms of their choice of sound materials: "musique concrète" preferred the use of natural sound sources, and "elektronische musik" constructed its sound material through the combination of pure electronic tones. While a number of studios developed in other countries during the 1950s, some with considerably less "rational" intentions than the two discussed here,<sup>1</sup> most did not maintain this distinction in sound sources. Nevertheless, it will be of considerable interest to the study at hand to focus some attention on this distinction.

#### Musical, Historical, and Institutional Factors

In 1907; the pianist and composer, Ferruccio Busoni, published his book, Sketch of a New Esthetic of Music (excerpts in Schwartz and Childs, 1967: 4-16). Busoni understood that a dependence upon the tempered system of tuning had seriously limited the development of Western music:

We have divided the octave into twelve equidistant degrees because we had to manage somehow, and we have constructed our instruments in such a way that we can never get in above or below or between them...Yet Nature created an infinite gradation--infinite! (Ibid.: 10)

Busoni advocated the construction of new instruments and the adoption of a system of tuning in sixths of a tone in order "to draw a little nearer to infinitude" (Ibid.: 13-14). Ultimately, Busoni's proposal for a revolutionary new aesthetics reveals an underlying rational pragmatism

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<sup>1</sup> John Cage established a studio in New York in 1951; it closed within a year and he only produced one work there. For this reason it will not be discussed here. Although Cage's use of chance procedures is often considered as "irrational," it is, in Weber's terms at least, a curious form of means-ends logic: a purposeless rationality. A full account of 1950s music would need to devote an entire chapter to Cage and his ideas but this is outside the scope of the present study of technology.

(if not conservatism) in that it sought to retain the rigid, mathematical basis of temperament and simply multiply it by three.

The construction of an instrument capable of producing sixths of a tone still troubled Busoni until he discovered what he thought to be a possible solution in an invention by the American, Thaddeus Cahill. Cahill's instrument, known as the "Telharmonium" or "Dynamophone," had been described in McClure's Magazine in 1906 as "an extraordinary electrical invention for producing scientifically perfect music" (Ibid.: 15). Busoni realized that with this instrument it would be a simple matter to mathematically calculate and fix pitch materials; he added a cautionary remark however: "Only a long and careful series of experiments, and a continued training of the ear, can render this unfamiliar material approachable and plastic for the coming generations, and for Art" (Ibid.). The rationality of Busoni's program is clearly articulated in the passages quoted above: the progress of music is dependent upon the creation of new instruments whose design is to be guided by science, mathematics, and experimentation, and whose use requires specialized training of perception.

During the inter-war years a number of electronic instruments were invented: the "Theremin" (1919), the "Trautonium" (1928), the "Ondes Martenot" (1928), and the Hammond Organ (1929) are among the most important. Like Cahill's instrument, they were mostly developed in isolation by individual inventors--the "engineering heroes" or the "creative artists of circuitry" as Gordon Mumma has called them (1975: 318-319)--the instruments bear the names of their inventors. What is significant about these instruments with regard to the study undertaken here is that they were not conceived as instruments for composition, but rather, for concert performance by trained instrumentalists. Some of them were designed with

special features to enhance the instrumentalist's control over certain expressive aspects of performance; for example, the "Ondes Martenot," a monophonic keyboard instrument, allows the performer to subtly manipulate the pitch and timbre of the instrument and to employ vibrato through a lateral motion of the key (a feature seldom found on electronic keyboard instruments even today). This emphasis on performance techniques was later considered by many composers to be among the essential drawbacks of the design of these instruments. I will return to this point later.

An important influence on electro-acoustic music (especially in France) was the Italian Futurist movement. Luigi Russolo's Futurist manifesto, "The Art of Noise," first published in 1913, called for the abolition of music played on traditional instruments and advocated the creation of a music based on sounds that had previously been considered as "noise": human noises, animal noises, the sounds of nature and, above all, the sounds of machines (including war machines). Unlike Adorno's description of Schoenberg's music quoted in the previous chapter where the concept of domination of nature had to be understood in terms of an earlier, musical/theoretical concept of "nature"; Russolo's manifesto, with its explicit desire to make use of all possible sounds in music, is an almost literal expression of the will to dominate nature: "We want to score and regulate harmonically and rhythmically these most varied noises" (Russolo, 1967: 9). Russolo's musical aesthetic is thus closely related to modern, instrumental reason: "Modern man takes the entirety of Being as raw material for production and subjects the entirety of the object-world to the sweep and order of production" (Martin Heidegger, in Marcuse, 1964: 153).

The Futurist aesthetic should not be confused with the desire to imitate natural sounds (a form of musical "mimesis"), which is evidenced in the music of many cultures and in many different periods of Western music history as well. For example, the imitative use of bird-song can be found in a variety of traditional musics throughout Africa, in the music of the Kaluli tribe in Papua New Guinea, in the medieval round "Sumer is icumen in," in the music of the twentieth-century composer Olivier Messiaen and, in recorded form, in Respighi's "Pini di Roma," etc. But with Russolo, the use of natural sounds goes beyond the desire to imitate. To be useful for his purposes, sounds must be objectified, rendered "abstract" through technical manipulation: "Through a clever variation of pitches, the noises lose their imitative and accidental episodic quality, and become abstract elements of art" (Russolo, 1967: 15).

The Futurist "art of noise" was certainly less rationalized than Schoenberg's highly ordered system of composition. Nevertheless, there is a quality in some of Russolo's writing that suggests a different kind of rationalism, a quasi-empiricism that would later come to be associated with electro-acoustic music: "We invite all truly gifted and bold young musicians to analyze all noises so as to understand their different composing rhythms, their main and their secondary pitches" (Ibid.: 13).

In many respects Russolo's manifesto is no more than a statement of intent: the technical means for the type of analysis, transformation, control and integration of noises that he envisioned did not yet exist. The search for those means was to continue throughout the decades that followed and perhaps no one was to pursue that search with greater intensity than the composer Edgard Varèse (1883-1965).



Varèse was perhaps heir to both Busoni's frustration with the tempered system of tuning and his desire for new musical instruments on the one hand (he was a close friend of Busoni from 1907 to 1914), and the Futurist interest in noise on the other (Russcol lists both the Futurist Russolo and the Dadaist Tristan Tzara among Varèse's "friends and admirers"; 1972: 47). His most impressive earlier works were written for percussion instruments--instruments with no fixed, tempered pitches and whose timbre contains a high level of noise content.<sup>1</sup> But beyond this, Varèse had come to believe that the composer, the acoustical scientist, and the electrical engineer would have to labor together in order to create the technical means necessary to finally escape the limitations of the older instruments and to meet the needs of the new noise music. What had only been implicit in the aesthetics of Busoni and the Futurists became a clearly defined "project" for Varèse.

Some of the reasons for Varèse's emphasis on the need for a collaboration between music and scientific research should perhaps be discussed here.<sup>2</sup> Firstly, Varèse conceived of music itself as an "Art-Science" whose "raw material" was sound (Varèse, 1967: 200). Certainly, an intimate relationship between science and music has existed in the West since Pythagoras; in his writing Varèse mentions the medieval conception of liberal arts where music takes its place in the quadrivium along with

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<sup>1</sup>The timbre of most percussion instruments is classified as "inharmonic," i.e., their harmonic structure is not mathematically regular as in the case of strings and pipes. Percussion instruments are thus not only a source of noise but also a convenient means of avoiding the "natural" tonal implications of traditional instruments. The problem of timbre will be discussed in more detail later in this chapter.

<sup>2</sup>It should not be assumed that the need for new instruments would necessarily lead one into the arms of science. The instruments of Harry Partch were developed entirely outside such a context; the aesthetic differences between Varèse and Partch are beyond the scope of this thesis.

mathematics, geometry and astronomy; and, as noted in the previous chapter, eighteenth-century theorists like Rameau also regarded music as a "science." But with Varèse, music becomes much more thoroughly identified with sounds as natural phenomena and thus, the object of scientific investigation. Quoting from the work of Wronsky and Durutte, two nineteenth-century musical mathematicians, Varèse defined music as "the corporealization of the intelligence that is in sounds" (Ibid.: 199).

Secondly, Varèse believed that musical "progress" was intimately tied to the development of scientific knowledge: "There is a solidarity between scientific development and the progress of music. Throwing light on nature, science permits music to progress...by revealing to our senses harmonies and sensations before unfelt" (Ibid.: 196). In Varèse, there is something akin to the spirit of the Renaissance experimenters as Weber had described them:

To artistic experimenters of the type of Leonardo and the musical innovators, science meant the path to true art, and that meant for them the path to true nature. Art was to be raised to the rank of a science, and this meant at the same time and above all to raise the artist to the rank of the doctor, socially and with reference to the meaning of his life. This is the ambition on which, for instance, Leonardo's sketch book was based. (Weber, 1958a: 142; Weber's emphasis)

It is interesting to note in regard to this that during his early years as a student, Varèse "prepared for an engineering career by studying mathematics and the sciences, and weaned himself on the notebooks of Leonardo da Vinci" (Russcol, 1972: 46-47).

Thirdly, while the early electronic instruments described above had been invented rather haphazardly, Varèse saw the advantages of pursuing his search for new instruments under laboratory conditions: "There should

be at least one laboratory in the world where the fundamental facts of music could be investigated under conditions reasonably conducive to success" (John Redfield, quoted in Varèse, 1967: 197). As early as 1927 Varèse had attempted to establish a collaborative working relationship with acoustical researchers at Bell Telephone Laboratories and, later, at sound studios in Hollywood; both these attempts failed. He continued to pursue the possibility of collaborative research up until about 1936 and applied on several occasions to the Guggenheim Foundation for the necessary funds; on each occasion he was denied a fellowship.

By the time electronic music studios finally began to appear after World War II however, Varèse's ideas, especially his concept of music as an "Art-Science," as "organized sound," and his insistence on the need for new electronic instruments, had become a source of inspiration to the younger generation of composers:

there was a sudden interest in electronic devices as possible sources of a new musical language...A scientific approach to music suddenly became fashionable. People remembered that [Varèse] had been predicting precisely this since 1916. (Russcol, 1972: 57)

In France, where Varèse was invited to work at the studios of the Radio-diffusion-Télévision Française, he had come to be regarded as a founding father of the new movement: "Dans les voies où nous allions, Varèse l'Américain avait été longtemps notre seul grand homme, en tout cas le précurseur unique" (Schaeffer, 1957: 20). Even in the area of popular music Varèse has been singled out by musicians such as Frank Zappa as an important influence on their musical aesthetics.

I have considered Varèse's ideas and activities at some length here because it seems to me that he occupies a position in twentieth-century

music that is remarkably similar to that of Francis Bacon in seventeenth-century scientific philosophy. Varèse's ideas concerning the relationship between science, natural phenomena and music; the centrality of scientific development in musical progress; his expressed desire for, and concrete efforts towards, the establishment of collaborative work between musicians and scientific researchers under organized laboratory conditions; and the enormous influence of his ideas on later generations of musicians; all support such an assertion. Furthermore, throughout Varèse's discourse on music there are distinct features that resemble Bacon's notion of the role of science and technology in the domination of nature:

I dream of instruments obedient to my thought and which with their contribution of a whole new world of unsuspected sounds, will lend themselves to the exigencies of my inner rhythm. (Varèse, 1967: 196)

[I] fight for the liberation of sound and for my right to make music with any sound and all sounds. (Ibid.: 201)

The link between the "liberation of sound" and the simultaneous development of new instruments of technical control is perhaps a typical expression of Western scientific and technological progress since the time of Bacon. Adorno's statement regarding Schoenberg's music and progress (already quoted in Chapter Two) seems particularly apt when applied to Varèse and his conception of electronic music: "With the liberation of musical material, there arose the possibility of mastering it technically" (Adorno, 1973: 52). Indeed, for Varèse, without technical mastery, "liberation" seemed impossible.

Of course, what is liberated here is not sound per se; rather, it is the composer who is liberated from the requirement of writing for a very specific and limited number of prescribed instrumental sounds. But to

liberate himself from instrumental sounds also meant that the composer was able to finally liberate himself from a specific social requirement as well—that of writing for instrumental performers. For Varèse it is clear that this latter form of liberation had also come to be seen as part of the promise offered by new technical means: "If you are curious to know what such a machine could do that the orchestra with its man-powered instruments cannot do, I shall try briefly to tell you: whatever I write, whatever my message, it will reach the listener unadulterated by 'interpretation'" (Varèse, 1967: 200). Much later, he was to assert that "Now that we have electronic instruments, the interpreter will disappear like the storyteller in literature after the invention of the printing press" (Varèse, in Russcol, 1972: 59). As discussed in the previous chapter, "interpretation" had been the last prerogative left to the performer as the result of musical specialization and increasing technical development in Western notation. For the composer, performance had come to be seen as a necessary, though non-productive aspect of musical practice. Technical development in music, as in other sectors under capitalism, had thus resulted in a devaluation of labor. The purposive guidance of radically new technical developments, such as electronic music, could render the performer/laborer redundant: the "adulterer" would become obsolete. The search for new technical means undertaken by Varèse was no longer a search for an electronic musical "instrument" but a search for a composing machine—a machine that would increase the composer's power over musical materials and the composer's sense of autonomy.

This sense of autonomy was largely illusory, for the composer's dependence upon the performer was simply transformed into a dependence upon the engineer (engineers, however, make no claim of partnership in the

creative process); the dependence upon orchestras was likewise transferred to other kinds of institutions. As already noted, the latter dependency was regarded by Varèse as a necessary precondition for organized musical research. Interestingly enough, Francis Bacon had foreseen such a development in music long before Varèse. In his essay "Origins" (1975), Otto Luening quotes a somewhat lengthy passage from Bacon's New Atlantis; I include only excerpts here:

We have also sound-houses, where we practice and demonstrate all sounds, and their generation. We have harmonies which you have not, of quarter-sounds, and lesser slides of sounds. Divers instruments of music likewise to you unknown...We represent and imitate all articulate sounds and letters, and the voices and notes of beasts and birds...We have also divers strange and artificial echoes, reflecting the voice many times... We have also means to convey sounds in trunks and pipes, in strange lines and distances. (Bacon, in Luening, 1975: 3)

Luening regarded this as "a remarkable prophesy of electronic music as it has developed in the twentieth century" (Ibid.: 4) and indeed it was, but perhaps even more so than Luening realized. For not only are the individual "prophesies" concerning tone generation, artificial reverberation, etc., of interest; but also, the fact that Bacon projected these developments within the institutional context of "Solomon's House" is in itself significant. The post-war development of electronic music was dependent upon institutionalized research for both technological and financial reasons:

Electronic music is, of necessity, institutional music because adequate equipment for its preparation is not cheap. Therefore the history of electronic music has been one of subsidized effort. In Europe, most electronic music studios are supported by government broadcasting agencies or private industry. In this country [the U.S.], universities and foundations will have to fulfill a similar role. (Hiller, 1963: 99)

While a detailed study of the institutional context of electronic music is outside the scope of this study, there are perhaps certain relevant issues that should be mentioned, if only briefly. Firstly, the cost of producing electronic music would appear to impose, from the outset, a certain level of rational, means-ends thinking:

the primary problem is that of finding continuous and sufficient funds for an adequate development. In a stringent budgetary situation the choice of which instruments to buy becomes more crucial; the instruments dictate the possible sounds as well as studio efficiency in producing them. (Chadabe, 1967: 107)

In electronic music there is a close relationship between the kind of music produced and the technical means; choices made prior to the actual music-making will have some influence on the compositional process.

Secondly, at a much more general level, the institutional context itself can contribute to an increased tendency towards rational, quasi-scientific modes of thought. This appears to have been the case in many North American universities when electronic music was first introduced:

The need in this academic environment to present composition as an ordered and intellectual pursuit, and the close physical proximity of so-called "disciplines" of scientific teachings, have contributed no small part to the large volume of systems and aesthetics in the past forty years. (Cope, 1971: 6)

This tendency towards a scientific approach to composition can manifest itself at the level of the university curriculum (at the University of Illinois, student composers follow courses in acoustics, electrical circuit theory, and information theory, as well as techniques in electronic music proper; Hiller, 1963: 122-123); at the level of individual aspiration (Milton Babbitt advocated that composition be accorded a

position of respect and support in the academy similar to that of mathematics and pure science, thus giving credence to Weber's comments, quoted earlier in this chapter, regarding the social ambition of artistic experimenters; Babbitt, 1958: 126); or in the 'compositional method' itself (information theory, probability theory, and other mathematical models of composition were prevalent throughout this period).

Thirdly, within large, bureaucratic institutions such as state-run radio and universities, authority and responsibility for the operation of electronic studios would be delegated to "specialists" in the field. These positions were also positions of power and in the early electronic studios such power tended to be wielded autocratically:

[Herbert] Eimert was very influential in the early development of electronic music in Germany. As director of the Cològne studio he was responsible not only for its physical but also for its psychological makeup. He selected both the equipment for the studio and the composers who would work there. (Schrader, 1982: 80)

Eimert was not unique in this respect: the early studios were often directed by a single person, or a small group of persons, who defined their technical and aesthetic character (Ibid.: 99).

The electronic studio may have liberated the composer from a dependency upon performers and the "middle-man" conductor, but in gaining access to large, institutionally-based instruments of production the composer still had to pass by the "overseer" of the operation. Thus, an analysis of the aesthetic theories and practices of a few key individuals can, to some extent, reveal the overall character of electronic music in its early development. The following sections of this chapter are devoted to such an analysis.



Inside "Solomon's House" I: Musique Concrète

The Futurist desire to make use of a broader range of sound materials in music reached a rather sudden and unprecedented stage of realization in the work of Pierre Schaeffer, in 1948. It was in that year that Schaeffer broadcast his first "Concert de Bruits" on the French radio network. Working with phonograph records (and later magnetic tape), Schaeffer established a new kind of music—which he called "musique concrète"—that would make use of any preexisting sound that could be recorded. With the aid of technology available at the studios of the Radiodiffusion-Télévision Française, the recorded sounds could be manipulated and transformed (through speed changes, editing, looping, filtering, reversal, etc.) and then, through techniques of montage, used to create a recorded composition. For the purposes of this study, there are three aspects of Schaeffer's work that should be addressed: the tendency towards isolation and objectification of sound material, the dependence upon methodical experimentation and classification, and the particular uses of the recording technology.

In his own writings Schaeffer contrasted the concept of "concrète" music with more traditional, "abstract" forms of music:

The qualification of "abstract" is used to describe ordinary music because it is first conceived of in the mind, then notated on paper, and finally realized only by instrumental performance. Musique concrète, on the other hand, begins with pre-existing sound elements, which may be music or noise. These elements are then experimentally manipulated and a montage is created. (Schaeffer, quoted in Schrader, 1982: 10)

There is a contradiction between Schaeffer's use of the term "abstract" as a characterization of traditional music and the actual

theories and practices of musique concrète. For while musique concrète may begin with actual (recorded) sounds, this material itself must be rendered abstract as part of the compositional process (Ibid.: 11).

The first step in this process of abstraction is the recording of sounds--the raw material of the composition: "The innovation that distinguished Pierre Schaeffer's work from earlier experiments was his isolation of the sound event...by means of the recording process" (Cross, 1968: 41). The "innovation" referred to here is not so much the use of sound recording which, by 1948, was hardly novel; but rather, the conceptualization of natural or musical sounds as isolatable, material objects --"fragments sonores existant concrètement, et considérés comme des objets sonores définis et entiers" (Schaeffer, quoted in Cross, 1968: 41).<sup>1</sup>

To be available for compositional purposes however, the "objet sonore" must not only be physically and conceptually isolated but also psychologically isolated by means of a disciplining of perception. According to Schaeffer, in order to hear the "objet sonore" as an event in itself it is necessary to change one's focus of attention away from the sound as an "indice" or "signe" for some other object or concept. This intentional turning away from any reference to the causes of the sounds, or other specific associations carried by them, Schaeffer calls "l'écoute réduite" (Schaeffer, 1966: 268-272). In this way, the sound world of musique concrète was to be a thoroughly "disenchanted" one, where both musical sounds and natural sounds were to have no intrinsic significance.

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<sup>1</sup>Canadian composer R. Murray Schafer refers to the dislocation of sounds in time and space as "schizophonia": "We have split the sound from the maker of the sound. Sounds have been torn from their sockets and given as amplified and independent existence" (Schafer, 1977: 90). The very ability to conceptualize a sound as an isolatable "object" is perhaps an expression of the modern experience of recorded sound.

Schaeffer had much in common with the Futurists (he was aware of their work and acknowledged his debt to them), both in his desire to make use of all sounds and to transform them into "abstract elements of art." The technology of sound recording could be an aid in this process in that it allowed for the manipulation and transformation of any sound according to the same set of technical procedures. Thus, sound recording allowed Schaeffer to succeed where the Futurists, and other early musical experimenters (e.g. George Antheil, who attempted to combine airplane propellers and other noise-makers with a symphony orchestra), had failed: by reducing all sounds to the same set of technical procedures the obvious differences between noise and musical sounds could be flattened.

Recognizing these aspects of musique concrète, the anthropologist Claude Lévi-Strauss has compared it to abstract painting of the same period:

By rejecting musical sounds and restricting itself exclusively to noises, "musique concrète" puts itself into a situation that is comparable, from the formal point of view, to that of painting of whatever kind: it is in immediate communion with the given phenomena of nature. And, like abstract painting, its first concern is to disrupt the system of actual or potential meanings of which these phenomena are the elements. Before using the noises it has collected, "musique concrète" takes care to make them unrecognizable, so that the listener cannot yield to the natural tendency to relate them to sense images. (Levi-Strauss, 1969: 22-23)

By prefacing his book-length structural analysis of Bororo Indian myths in this way, Levi-Strauss made a striking comparison between a culture where all of nature is "enchanted"--has been made to signify--and modern culture where nature has been drained of all meaning: "'Musique concrète' may be intoxicated with the illusion that it is saying something; in fact, it is floundering in non-significance" (Ibid.: 23).

Through technological means and a specialized disciplining of perception sound is transformed into an "object": musique concrète is thus a process of abstraction and objectification--objectification, for the "Frankfurt School," was the first step towards technical mastery and the domination of nature.

The second step in this process is the analysis and classification of the sound material through experimental technique and observation. Schaeffer advocated "empiricism" as the only proper method of electro-acoustic composition (Schaeffer's early training at L'École Polytechnique was perhaps influential in this respect). He felt that the two warring factions of avant-garde music during the early 1950's--serialism and chance music--both tended to disregard the materiality of musical sounds in favor of preordained systems of formal organization. By concentrating on the unique properties of the "objet sonore," Schaeffer attempted to resist "l'esprit de système appliqué à la démarche concrète, au constructivisme prématuré de musiciens qui ne respectaient pas assez à mon [Schaeffer's] gré l'empirisme expérimental" (Schaeffer, 1957: 23). Schaeffer believed that the development of musique concrète would be dependent upon methodical research and classification of sound materials according to their type and morphology: "Le son ne saurait plus être caractérisé par son élément causal, mais par l'effet pur. Aussi, doit-il être classé, non selon l'instrument qui le produit, mais selon sa morphologie propre" (Ibid.: 26).

To work methodically in this way with a diverse set of new materials changes the nature of composition from a form of artistic creation to a form of rational, quasi-scientific research:

considérant que la découverte des objets sonores était primordiale, qu'il fallait d'abord en fabriquer beaucoup, en déterminer les catégories et les familles, avant même de savoir comment ils pouvaient évoluer, comment ils pouvaient être assortis et combinés les uns aux autres, je cherchais impatientement d'assez bons musiciens et des musiciens assez désintéressés pour oser ce travail gigantesque, ressemblant davantage à celui du botaniste qu'à celui du compositeur. (Ibid.: 19)

Thus, given Schaeffer's scientific aspirations ("When I compose, it is with a desire to research rather than to express"; Schaeffer, 1980: 11), it is not surprising that the highest praise that he could bestow upon his long-time musician/collaborator, Pierre Henry, was not that he was a great composer but rather "un expérimentateur essentiel" (Schaeffer, 1957: 19).

In musique concrète, musical form was not to be derived from pre-determined formal schemes but generated from the material itself once its formal properties had been thoroughly understood through scientific observation, analysis and classification. To this end, Schaeffer proposed the formulation of a new system of "solfège" in which "extra-musical sounds could be treated musically by determining for them a familial or a scalar ordering, yet allowing them to retain the essence of their noise-like properties" (Cross, 1968: 41; see also, Livre VI, in Schaeffer, 1966).

This attempt at a musical systematization of materials and the generation of musical form according to the observable qualities of sound phenomena distinguished the musical and theoretical position of the Paris school of musique concrète from that of the German serialists (who will be described later), who relied on the electronic synthesis of tones:

I [Schaeffer] readily admit my predilection for natural materials, my preference for the grain of wood or marble, for the formal properties of a seashell or an agate.

I dread a profusion of synthetic materials which are too homogenous, too maleable and suggest no inherent form. (Schaeffer, 1980: 8)

The idea of an "inherent form" suggested by natural sounds is thus Schaeffer's version of Rameau's "self-evident principle": whereas Rameau proposed a "natural" justification of chordal structure based on the scientifically observable harmonic series; Schaeffer proposed a "natural" justification of the dynamic shape of the musical work based on the scientific observation of sound morphology. More than a simple "preference" or distinguishing feature of the music, Schaeffer's notion of "inherent form" is a consistent ideological underpinning of musique concrète. With the idea of "inherent form," Schaeffer did not seek to create musical meaning but to discover it, empirically, in the surface characteristics of the sounds themselves--in their internal structure, not in their identity (as referent).

An essential difference between Rameau and Schaeffer is that whereas the former stressed the importance of both scientific observation and mathematics, the latter tended to eschew mathematics in favor of a strict dependence upon the ear, as aided by technology. Schaeffer made a clear distinction between the "objet sonore," which is given to perception and is of use to the composer as a generator of form; and the "signal physique," which is of interest to the acoustician as a thing to be measured (Schaeffer, 1966: 269). In this way, Schaeffer was less "scientific" than Rameau: his approach is characteristic of Weber's second element of rationalization (in its emphasis on methodical, scientific observation) but is not fully complemented by that other form of rationalization that seeks to mathematize and calculate.

The third aspect of Schaeffer's work is that it is completely dependent upon a kind of technological rationality--that is, the purposeful organization of technical means (including both the "tools" of production and a clearly defined set of productive techniques). The technology of sound recording and its various uses permeates every aspect of musique concrète: firstly, the tape recorder (or the phonograph, and of course, the microphone and other ancillary devices) is instrumental in isolating the individual sound object; secondly, it presents the sound to the composer in a tangible form such that it is made available as "raw material" to be manipulated and transformed (through editing, filtering, speed changes, etc.); thirdly, it offers the possibility of organizing the sound material (through layering and montage) into a compositional form; and finally, it becomes the vehicle for the "performance," or reproduction of the work (the distribution of the composition over loudspeakers in space will be taken up in the next section of this chapter).

In Chapter One it was noted that Francis Bacon advocated the use of technology over simple, direct observation as a more powerful means of gaining knowledge of, and mastery over, natural processes. In musique concrète, knowledge concerning the morphology of the sound object is not based on observation of sound in its natural context but on observation of sound as made available through technology (isolated, slowed down perhaps, etc.) or, as Bacon put it, "under the vexations of art." Furthermore, this use of technology simultaneously offers the possibility of not only learning about sound but also of controlling it: Schaeffer states that musique concrète "is concerned with the acoustics of recorded natural sounds on which we then have the power of transformation" (in Diliberto, 1986: 56). Thus, knowledge gained through technology is also power

over nature, mastery over the object of knowledge. Many of the studio techniques developed by Schaeffer appear to have less to do with revealing the "inherent form" of individual sounds and more to do with controlling and distorting them. For example, through the cutting and splicing of tape it is possible to isolate a given sound from a sequence of sounds in order that it may be closely studied. At the same time, by cutting off the attack or decay portions of the sound, the natural dynamic shape, or "envelope" of the sound can be altered. In practice then, the sound object has no "essential" morphology of its own, only that which the composer wishes to give to it.

The perception of the "inherent form" of the sound material does not necessarily determine the compositional form; for here, the organization of the technical means themselves also plays a significant role. In his analysis of Schaeffer's early musique concrète works, Barry Schneider notes that repetition (through the use of a "locked-groove" technique of disc recording) is the most important feature of the compositions. While it could be argued that repetition is inherent in machine noises (e.g. the sound of steam engines<sup>1</sup>), the technique of looping became such a basic aspect of Schaeffer's music that it lost any relationship that it may have had to the actual sound materials.

At another level, Schaeffer's use of repetition played an entirely different function for it was not only a formal element of the music but also part of the way in which isolated natural sounds could be transformed

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<sup>1</sup> It is interesting to note that in deciding how to best display the power of his new techniques Schaeffer chose the sound of the locomotive (that most potent symbol of nineteenth-century technological power and progress) as his subject matter. Of course, the Lumière brothers had done essentially the same thing fifty years earlier in their film, "A Train Arriving at the Station." By the time of Schaeffer's 1948 "Etude," the train was, at best, an anachronistic, sentimental image of techno-power.



into abstract musical material: "Repeat the same sound fragment: It is not the same, it has become music" (Schaeffer, in Schrader, 1982: 12).

For Schaeffer then, repetition through mechanical reproduction has come to be regarded as a basic, defining characteristic of musicality itself.<sup>1</sup>

Of course, rhythmic or thematic repetition of musical materials is a deeply rooted element of musical form in all cultures. However, Schaeffer's use of repetition does not arise out of a physiological or musical need (i.e., the biological desire for regular pulse and rhythmic patterning, or the need for mnemonic aids that lend structural coherence in a temporally-based art form); but rather, it arises out of a rational, and systematic exploration of technological possibilities. In a passage reminiscent of Max Weber's own analysis of the importance of notation in Western music, Barry Schrader compares Schaeffer's *musique concrète*, with its reliance on the technology of sound recording, to the early development of polyphony through notational art:

It is important to note that this interplay between technology and musical thought has occurred throughout the history of music. The music staff was invented to accommodate the needs of organum; but once this was achieved, the new technology of the staff allowed for the development of polyphony, which then made further developments of notation necessary. Schaeffer's ideas about using train sounds as musical material depended upon the recording technology of the time. This technology

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<sup>1</sup>In his book, *Bruits* (1977), Jacques Attali argues that monopoly capitalism in the twentieth century can be characterized by a notion of "répétition" derived from his analysis of disc recordings as the basic commodity form of present-day music. A number of issues raised in this chapter can be related to his general analysis. Surprisingly enough, despite his concern with repetition and "noise," Attali has little to say about electronic music. For this reason, and because certain aspects of Adorno's approach to the analysis of music (already discussed in Chapter Two) are echoed in Attali's work, I have not included Attali's ideas here.

partially dictated the compositional procedures, aesthetics, and theories that led to the completed work. (Schrader, 1982: 12-13)

Schrader's comments come close to a kind of technological determinism: for while it is certainly accurate to say that the technical procedures of musique concrète were dependent upon the recording technology of the time, it does not follow that those procedures were necessarily "dictated" by the technology, and much less so the aesthetics and theories of musique concrète. From Weber's point of view it might be more accurate to say that there is a complex interaction between the possibilities offered by a given technology and the rational organization, development and utilization of those possibilities through methodical experimentation, itself guided by aesthetic, social, economic, or other goals. As pointed out earlier in this chapter, the aesthetic orientation of musique concrète preceded its technical realization by several decades.

The comparison with notation is an apt one however, and, despite the fact that recording technology renders notation, in a sense, obsolete, certain rational habits of thought are carried over and redefined in the use of the new technology. For example, in the previous chapter I cited Trevor Wishart's observation that notation offered the possibility of a spatialized conception of time. The rational segmentation of time and space is inscribed in the very operation of the tape recorder itself: fifteen inches of tape is equal to one second of time. With this in mind, the composer of musique concrète creates durations, rhythms or pulses through a simple measurement of tape in inches (Schaeffer appears to have had no reservations concerning the use of this bit of mathematics for compositional purposes). Furthermore, not only are musical pat-

terns reversible, as with notation, but the morphology of the sounds themselves can also be reversed; thus offering a control over natural processes never before realized.

Musique concrète represents an increase in musical rationalization in both its use of technology and its scientific, empirical approach to sound materials. Furthermore, the objectification and manipulation of any and all sounds through technological means can be regarded as perhaps the first true realization of the will to dominate nature in musical terms. As mentioned earlier however, the rationalization and objectification of natural sound was not complete in music concrète: it had not become mathematized and subjected to abstract forms of calculation. A more thorough rationalization did occur in Germany however, where synthetic models of tone generation were adopted.

#### Inside "Solomon's House" II: Elektronische Musik

From the outset, electronic music in Germany was regarded by its proponents as the fulfillment of a compositional ideal, "the focal point of a progressive development" (Eimert, 1958: 1). The ideal, and the specific notion of "progress" put forward, was essentially the same as that put forward by Adorno a decade earlier in his description of Schoenberg's twelve-tone method: "total organization of the elements of music" --in this case, "total organization of the electronic sphere" (Ibid.: 2). In the previous chapter I argued that Schoenberg, who wrote for the traditional instruments of the orchestra--instruments tuned to the traditional chromatic scale and played by fallible, human performers--and who had no choice but to make use of an at best, approximate form of notation, lacked the technical means to realize a form of organization and control

that was anywhere near as "total" as Adorno had claimed. The composer's associated with the studios of the Nordwestdeutscher Rundfunk (Northwest German Radio) in Cologne during the early 1950s, especially Herbert Eimert and Karlheinz Stockhausen, consciously set out to rectify that technical inadequacy through the use of electronic means.

In some ways, the techniques and practical concepts of *musique concrète* and *elektronische musik* are similar: both make use of cutting, splicing, and other tape manipulation techniques. The fundamental difference between them (at least in the early days) was that whereas the Paris school used natural, acoustic source material, the Cologne school advocated the exclusive use of electronically generated sounds (especially so-called "sine tones"--pure electronic tones without harmonics). Far more than a simple statement of preference, the decision to synthesize sound directly was firmly rooted in the formal logic of the German movement towards "integral serial technique" (the subjection of all elements of music--pitch, duration, intensity, timbre, etc.--to ordering procedures similar to the twelve-tone method; Anton Webern's extension of Schoenberg's principles of construction to aspects of musical form other than pitch, prior to World War II, was taken as the point of departure by the new movement). For the purposes of this thesis, I would like to concentrate primarily on the German school's concept of timbre in relation to the compositional method. The role of information theory, the use of the technology itself, and the incorporation of spatial movement as an aspect of composition will also be discussed.

Control over timbre is perhaps the most important aspect of the electronic music produced at the Cologne studio during the early fifties. Certainly the precise control of pitch materials, which were no longer

confined to the twelve pitches of the tempered chromatic scale; duration, which could be precisely controlled through the measuring and editing of tape; and, above all, dynamics, which could be controlled with a degree of precision impossible through traditional notation and live performance, are all important considerations in the shift to music made with electronic means. But control of timbre is decisive because for the first time the composer was able to shape the microstructure of individual sounds in accordance with the overall compositional scheme: "one comprehensive idea of working suffices to provide the elementary microstructure as well as the macrostructure of a composition" (Stockhausen, 1958: 51).

Often, in the literature on the history of electronic music, the reasons for the emphasis on the control of timbre are not clear; it is most often considered as an extension of Schoenberg's "klangfarbenmelodie" (discussed briefly in Chapter Two; for an example of the "klangfarb" connection, see Schrader, 1982: 86). In my own research, I have found that the issue of timbre is much more complex than this; its importance is two-fold. Firstly, the construction of new, non-instrumental timbres makes it possible to create sounds that are free of external associations. It was felt that "all instrumental or other auditive associations...divert the listener's comprehension from the self-evidence of the sound world presented to him" (Stockhausen, 1961: 62). Whereas musique concrète strove for this type of free-floating "abstraction" of sound material through the manipulation and transformation of natural sounds, the electronic generation of tones provided a more rational and effective means of achieving this goal.

Secondly, and more importantly, it was realized that control over the microstructure of sound was necessary to overcome a basic contradic-

tion between serial compositional technique and the harmonic structure of traditional instrumental timbres. To fully understand the contradiction posed by instrumental sounds it is worthwhile to once again recall Rameau's theory of harmony presented in Chapter Two. With Rameau, the structure of chordal harmony was directly related to the microstructure of tones as perceived in the natural overtones of vibrating strings and pipes. Thus there was a kind of "fit" between the two levels of structure--the micro-level of the tone itself and the musical level of the chord. Adorno had claimed that Schoenberg's method of composition--which justified chordal structure on the basis of the overall formal scheme of the work--was able to cast off this musical "force of nature." But in actual fact, Schoenberg, who lacked the technical means to liberate himself from traditional musical instruments, was simply forced to ignore the theoretical, and aural contradiction between the two levels of structure:

This resulted in the fundamental contradiction between the physical nature of the traditional instrumental sounds and the new musical ideas concerning form...For this very reason, the radical twelve-tone music of the first half of the century appeared "impure" because the operations of the composers with the given materials were not functional. (Stockhausen, 1961: 59)

It is unlikely that Schoenberg himself felt as strongly about the nature of this contradiction as did his followers; in any case he had no choice but to deal with the materials at hand. For the post-War generation of serialists however, there could be no question of bending to the material now that new means of creating sounds existed; to do so, in their view, would be equivalent to a return to the music of the past. Instead, through a close study of acoustics (Stockhausen spent more than a year

in Paris analyzing instrumental and percussion sounds and, later, studied phonetics) and the application of electronic means, the composer could learn to create his own materials:

The musician, therefore, for whom the question of research in sound had for the first time become acute, has been obliged to undertake a considerable amount of this research himself... This will be indispensable to those composers who are not content to accept sound phenomena as given facts, but who, in opposition to the dictatorship of the material, attempt to drive their own formal conceptions as far as possible into the sounds in order to achieve a new concord of material and form: that of acoustical micro-structure and musical micro-structure. (Stockhausen, 1961: 60)

It is clear in the passages cited above that for these composers to liberate themselves from tradition and from what they perceived as the "dictatorship of the material," it was necessary for them to establish, through the acquisition of scientific knowledge, their own power, their own "dictatorship" over the material itself: "to drive their own formal conceptions as far as possible into the sounds." Scientific knowledge was to be instrumental knowledge, technically exploitable knowledge, and thus, a form of mastery. The significance of all this with regards to the new technical means was made explicit by Eimert: "only in coming to electronic music can we talk of a real musical control of Nature" (Eimert, 1958: 10).

But the term "Nature" in this context no longer refers to an external nature whose characteristics are revealed through empirical technique and then dominated through the rational application of technology (as in the case of musique concrète); but rather, the nature referred to here is an entirely synthetic one--one fabricated precisely for the purpose of domination:

[the compositional micro-structure] runs parallel to instrumental sound not in the manner of accrued imitation, but as an artificial procedure of order. Everything is designed not to escape from the nature of electronic sound, but to go further into it. No composer would set himself this task were he not certain that the idea of order running parallel to Nature was something he could believe. (Eimert, 1958: 10; the use of small "n" and capital "N" in the word "nature" in this passage is Eimert's)

The type of domination of nature expressed in the aesthetic principles and technical procedures of electronic music is quite different from that of *musique concrète*. The latter could almost be said to belong to an earlier stage of modern science and technology when external Nature, or at least the idea of an external Nature, was the object of man's investigations. The Cologne school on the other hand, seems to reflect a later stage, such as that reached during the late nineteenth century with the development of synthetic fibers, or perhaps that reached at about the middle of this century with the development of plastics (Stockhausen himself has compared electronic music to the discovery of new chemical compounds; see Worner, 1973; 124). In a brief but perceptive essay, the German musicologist H.H. Stuckenschmidt interprets this new situation by referring to the work of the modern physicist, Werner Heisenberg:

In a world completely transformed by human hand... we are continually presented with humanly conceived forms. In the natural sciences, the object of research is no longer Nature itself, but a Nature deprived of its absolute autonomy of behaviour and controlled by human intervention. The natural scientist sees an image of Nature which is in reality an image of human relationship to it. ...One would do well to apply much of this view of the present situation to any attempt to determine the relationship of man to this "completely transformed" music with its "humanly evoked" forms. (Stuckenschmidt, 1958: 12)



The relationship of man to this "'completely transformed' music" is one of control and domination, one of "total organization."

A brief look at one of the most well-known works of early electronic music may help to clarify some of the issues raised thus far. I have chosen Stockhausen's composition, "Studie II" (1954), for this purpose (because timbre is the central concern here, I will only discuss the work's pitch structure; the analysis is derived from Schrader, 1982: 83-88; and Nisbett, 1979: 435-437). In this work, Stockhausen begins with an arbitrary division of the available pitch space: as in the temperament of keyboard instruments, the interval between frequencies is mathematically based and is equal to the  $25\sqrt{5}$  (whereas temperament is based on a division of the octave, Stockhausen divides the interval between a tone and what would correspond to its fifth harmonic). With this quasi-chromatic scale of frequencies (each is made up of a single sine tone), Stockhausen constructed a set of five different timbres, or "note mixtures." These in turn could be combined in different ways to create chord-like structures. What is striking about this organization of pitch materials is the absolute symmetry between various levels of structure. This symmetry comes from the fact that Stockhausen begins with a mathematically equal division of his basic materials. As will be recalled from Chapter Two, equal temperament was, in a sense, imposed upon natural tonal materials: the tuning of intervals smaller than an octave had to be adjusted and made "out of tune" with the natural harmonic series--the harmonic series is not itself divided equally (the ascending intervals become ever-smaller); likewise, triadic harmony is made up of chords with unequal intervals (a major and a minor third). Thus, temperament, as a system of order, stands in contradiction with natural order which it must then

dominate. Stockhausen's system of order allows for no contradictions; it is a system of formal order that has found a rational, technological means (electronic synthesis) of forming its own materials. With "Studie II," one is presented, as it were, with a completely "tempered" universe: the macro-structure (the total pitch space), the musical structure (the chord formations), and the micro-structure (the timbres, or "note mixtures"), all conform to a single, uniform set of proportions. Whereas temperament was created so that the composer could enjoy greater freedom in modulating from key to key in tonal music, Stockhausen's system was created out of a desire for spatial order—a desire for "total organization."

While the possibility of synthesizing tones marks a new stage in the history of musical technology, it is clear that the spirit and the formal logic that underlies the musical theory of the Cologne school is still firmly rooted in Enlightenment thought. Serialism seeks to unify, to order, to harmonize all aspects of the composition within a single, logical scheme. The universal mathematical character of this musical theory finds its origins in what is perhaps a contemporary offshoot of the Enlightenment: information theory. Werner Meyer-Eppler, a physicist, director of the Institute of Phonetics at Bonn University, and a founding member of the Cologne studio, had been impressed by Shannon and Weaver's Mathematical Theory of Communication (1949); and through his teaching and interest in electronic music, appears to have exerted considerable influence on the Cologne school (Luening, in Russcol, 1972: 266-269). This influence can be found in the compositions of Eimert and Stockhausen that use recordings of isolated phonemes (e.g. Stockhausen's "Gesang der Jüng-

linge," 1956) but also, at a more general level, in their predilection for the statistical ordering of sound material.

Adorno had noted that Schoenberg's twelve-tone method displayed a certain mathematical bias; in the work of the post-War serialist, a general orientation towards mathematical and statistical models becomes explicit. In part, this was necessitated by working with the new technology, which presented the composer with an undifferentiated continuum of pitch levels, dynamic levels, etc. The composer's control over these materials was mediated by the technology in a way that was different from the more direct experience of a performer who plays a traditional musical instrument:

we no longer "play" the music according to our perception. Technical ways of measurement stand between us and our musical material... Thus a conscious realization is forced upon us of what previously has been practised as being obvious. Our invention has to be expressed in terms of technical quantities. (Stockhausen, 1958: 49)

The musical ideas of Stockhausen are replete with references to the idea of a "continuum" in all dimensions of musical material (pitch, duration, intensity, etc.). The "row," originally designed by Schoenberg as an ordering of pitch relations, is replaced by a set of mathematical proportions or statistical structures that can be applied throughout these various dimensions (or "parameters"). The theoretical conception of the tone (itself based in the concepts of information theory) is one where the tone has been totally fragmented: the various dimensions do not interact in any way but are conceived of and calculated as if they were completely separate elements. Whereas in the natural sound world and in the world of conventional musical instruments attack and intensity,

register and timbre, duration and tempo, all interact in a variety of complex ways, electronic music treats these elements as completely separate and independent. The problem (mentioned briefly in the previous chapter) concerning the discrepancy between the notated structure of a musical work and the music as heard, reaches a new level of intractability in the music of the Cologne school. For while the composer may conceive of these dimensions as separate, the actual tone itself will always be perceived as a "gestalt"; the listener's ability to separate the various dimensions of the tone will be limited.<sup>1</sup> In an article on the use of information theory in music, Joel Cohen (1962) discusses these, and other problems of information theory, that render it inadequate as a tool for the analysis of conventional music or for the composition of musical works. In a sense, the problem could be related to Schoenberg's twelve-tone method which guaranteed the "'indifference' of harmony and melody," only in electronic music, the various parameters of the sound lose their identity entirely: they become absolutely interchangeable as individual bits of objectified mathematical logic.<sup>2</sup>

Stockhausen was not unaware of the problem and, interestingly enough, rather than reject this objectification of the material, the solution he

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<sup>1</sup>Once again, to pursue this line of reasoning concerning what is essentially a problem of communication of the work would go beyond the scope of the thesis. But it should perhaps be mentioned that while Stockhausen was concerned about these discrepancies, others at times seemed more interested in an idealized notion of the structural integrity of the "work" than with its reality as an aural experience (Babbitt, 1958: 39).

<sup>2</sup>With the Columbia-Princeton R.C.A. Synthesizer of the 1950s, which, like computer systems, uses a binary coding system in order to control the various synthesizer modules, this problem becomes particularly acute. In an article describing the system, Milton Babbitt assures the reader that such problems of mathematical objectification do not "launch one on the road to randomness" (Babbitt, 1964: 259).

proposed would actually give the composer control over an entirely new structural element in music: spatial distribution.<sup>1</sup>

All musical elements had equal rights in the forming process and constantly renewed all their characteristics from one sound to the next. If all characteristics of the sound are continually altered to the same degree... then the music finally becomes static...one finds oneself in a state of suspended animation, the music 'stands still'....

a solution was found to distribute in space, among different groups of loudspeakers, or instruments, various long time-phases of this kind of homogeneous sound-structure. Up to then spatial composition of sounds had played no active part in music; it was therefore perceived as an 'entirely different' sound-property which would hardly be in a position to dominate over the sound-characteristics associated with time. (In the meantime this has fundamentally changed, and we notice more and more how all musical ideas are becoming increasingly spatial.) (Stockhausen, 1961: 69-70).

Thus, the fragmentation of the tonal material renders music static. Once thought of as an art fundamentally rooted in the "uni-directional continuum" of time, music becomes a multidimensional tone/space. Now the composer's mastery over the materials of music could, for the first time, extend from the micro-level of the tone, to the macro-level of the work, and to the meta-level of the performance space itself. Just as Stockhausen had refused to accept instrumental timbre as "given," he now refused to take space as a given: each work would create its own spatial organization.

While the use of technology in the classical studio (oscillators, filters, ring modulators, etc.) is mostly dictated by the formal logic of serialism, there is another level of rationalization that comes about because of the technology itself and the need for efficient working methods:

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<sup>1</sup>While not discussed earlier, the spatial aspects of sound were also a concern for Varèse and the French school of musique concrète.

The statistical nature of serial composition requires a rationalization of production. The manifold quality of the music requires a corresponding complexity of electrical and recording technique...Rationalization is not only the technical consequence of the artistic construction, but a matter of technical quality. The more the sound is subjected, once produced, to further processing, the worse its quality becomes...One solution for this problem can be provided by a thought-out plan of realization, which translates the musical structure into a technical one. (Koenig, 1958: 52-53)

In the early days, the low level of technology (requiring much tape editing and duplication) required a high level of rationalization. New solutions were eventually found in the form of amplitude modulation and frequency modulation. These technical processes had a dual advantage in that they could produce complex tones efficiently and in such a manner that their harmonic spectra could be predicted mathematically.

The studio itself was designed along the principles of modularity: whereas traditional instruments have a fixed character, electronic sounds had to be specified, in detail, both in a conceptual and a technical format. The breakdown of the studio into a set of special-function devices is perhaps the technical equivalent of the fragmentation of the tonal materials themselves. The design philosophy of modularity is one of the reasons why a live performance electronic instrument did not develop until the late sixties (and even then, designed for the pop market).<sup>1</sup> Everything about the electronic studio was designed for maximum flexibility: every work, at least in theory, could create its own configuration of technical devices. Just as the twelve-tone row was unique to each

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<sup>1</sup>The Canadian composer/inventor Hugh LeCaine is an interesting figure during this period. His design for a performance synthesizer was never marketed, in part, one might assume, because of the dominant 1950s philosophy of modular design and the rejection of the interpreter's role in music-making (see Young, 1981).

work, the technical plan and even the tapes containing the original timbres created for any individual work were destroyed after the composition had been realized (Stockhausen, 1958: 51; 1961: 61). Thus, as music as a temporal art ~~is~~ transformed into a spatial one, no two works will be allowed to have structural similarities that would identify them as part of a "tradition": in this particular strain of modernism, the composer, in order to protect the integrity of the work, must constantly burn his bridges behind him.

In the vision of "progress" that serialism had constructed for itself, the musical work was to gain a new level of autonomy: each work would be totally organized at all levels of the material thus guaranteeing the formal unity of the work and its uniqueness (the latter set the works off from the world of mass produced goods by becoming its direct opposite). The rationalization of the work was achieved both through mathematics and the organization of technical means thus, unlike musique concrète, both scientific and technological rationalization played equal roles in the formation of the work.

### Conclusion

The relationship between mathematics, acoustical science, technology and music is not new. Indeed, the bonds that link music and mathematics reach at least as far back in time as the sixth century B.C. to Pythagoras, and those with technology are as old as instrumental music itself. But there are perhaps few periods in history when the "progress" of music has been so consciously harnessed to scientific and technological development as it appears to have been during the present century.

Furthermore, as I have argued here, many of the composers who advocated the development and use of new technology in music, both before and after the war, adopted theoretical positions that were clearly in keeping with the philosophy of modern science: the domination of nature.

For a time, the theoretical differences between musique concrète and elektronische musik appeared irreconcilable. Nevertheless, there existed a basic similarity especially at the level of the rational organization of the tools and techniques of production but also at a deeper, motivational level. As the techniques of electro-acoustic music began to be taken up elsewhere, the theoretical differences came to be regarded as superficial: "what really counts is the approach itself...[which] is not to be identified only with its technical means but also with the inner motivation of our musical evolution" (Berio, 1956: 83). That inner motivation could perhaps be described as the search for unity: the search for "inherent form" on the one hand, and "total organization" on the other. In this respect, the two early schools of avant-garde electronic music were not opposite, but complementary. And this is perhaps also more generally true in the field of science:

the Enlightenment recognizes as being and occurrence only what can be apprehended in unity: its ideal is the system from which all and everything follows. Its rationalist and empiricist versions do not part company on that point. Even though the individual schools may interpret the axioms differently, the structure of scientific unity has always been the same. (Horkheimer and Adorno, 1972: 7)

The search for unity of form through technical mastery of musical materials was accompanied by what Leiss refers to as a characteristic "ideological reflex": the transformation of domination into an apparent form of "liberation." From the outset this liberation was viewed as



being two-sided: liberation of sound and liberation from the performer. It is not the case that the composer had also become the performer in electronic music. Indeed, composers of the period consciously rejected earlier electronic musical instruments that had been designed for performance purposes. But it would be misleading to suggest that performers were about to disappear (as Varèse had said they would) or that these composers stopped writing for traditional instruments. Indeed, some among their ranks were to lead the way to a reevaluation of performance during the late 1950s (see Stockhausen, 1961: 66).

This shift appears quite surprising given the stridency with which the demise of the interpreter had been predicted only a few years earlier. There is a sense in which this return to performance was, in part, necessitated by the manner in which information theory had reduced all elements of the tone to an essential meaninglessness, or by the realization that some limit to rationalization had been achieved, beyond which there could be no further "progress" (Schrader, 1982: 82-83). Reflecting back on the period since the 1950s, Schaeffer commented on the adoption of "freer" less controlled methods on the part of the former serialists (his own polemical position of course should not be ignored):

These 20 years of extreme boredom, marked in Paris, for example, by the concerts of the "Domain Musical," had a number of logical outcomes. Scores were permuted so that a work was never performed in the same way twice. It was all very clever. In Italy it was called "an open work." Behind this game the composer yielded some of his control and it was necessary to be grateful to him for this act. It was in effect a period of self-analysis and criticism, the composer's contemporaries did not ignore the fact that he had sinned through will to power. (Schaeffer, 1980: 9)

During the last twenty years there has been a proliferation of musical styles and new approaches to music-making. Throughout this period it has appeared as though the problems raised by rationalization and the "will to power" have either resolved themselves or have simply been abandoned. But within this overall search for new musical means there are still areas where science and musical "progress" continue to break new ground: for example, consider bio-music systems that

use biological potentials in feedback loops to induce powerful, predictable, repeatable, physiological/psychological states, which can be elegantly controlled in real time...the hallucinogenic powers of electronic sensory feedback systems can be controlled and guided with a precision utterly impossible with chemical methods. (Manfred Eaton, quoted in Luening, 1975: 21)

Having conquered the micro-structure of tones and then moved outward to conquer the meta-space in which the work is to be heard, the next logical step would apparently be to confront the listener directly so that he can be integrated into the technological apparatus itself. While it certainly could not be said that research into bio-music systems has become a major preoccupation in contemporary music, its existence does suggest that the limits to rationalization and the domination of nature (and man) have not yet been achieved.

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CHAPTER FOUR  
TECHNOLOGY AND POPULAR MUSIC

One of the interesting things about pop music is that you can quite often identify a record from a fifth of a second of it. You hear the briefest snatch of sound and know, "Oh, that's 'Good Vibrations,'" or whatever. A fact of almost any successful pop record is that its sound is more of a characteristic than its melody or its chord structure or anything else. The sound is the thing that you recognize. (Eno, 1986: 76)

Ever since the demise of popular music publishing (with its valorization of notation over performance) and the rise of the recording and broadcast industries, the search for the right "sound"--the sound that would capture the ears and the imagination of the consumer--has been a matter of increasing concern. Now the possibility of identifying a pop recording after hearing as little as "a fifth of a second of it" is, no doubt, as much a result of overexposure (thanks to tight rotation on Top 40 radio) as it is to a record's particular "sound." Nevertheless, the notion of a unique "sound" is a prevalent one in popular music: the term has been used as a general label, as in referring to the "Pop," "Commercial," or "Hit Sound"; or more specifically in reference to a particular place, as in the "San Francisco," or "Nashville Sound"; a time, the "Sound of the '60s"; a kind of music, the "Beat," "Disco," "Reggae," or "Punk Sound"; or, perhaps less often, in reference to the work of a specific producer, as in (Phil) "Spector Sound." Exactly what it is that constitutes the "sound" may be somewhat difficult to describe; it

is usually a combination of instruments, vocal and musical styles, and something else--something that could be described as both a particular technology and a particular mode of production: multitrack recording.

Multitrack recording is a relatively new innovation in the history of sound recording. Its main development occurred during the decade between 1965 and 1975. Before 1965, studios were generally not equipped to deal with more than four tracks of recording; by the end of the sixties, 8-, 16-, and 24-track equipment had been introduced; and by the mid-seventies, the final mixing process had become so complex that automated mixing consoles were being developed. The most intense period of development appears to have taken place during the five-year period from 1968-1973. During this period the number of new studios in the U.S. grew to about 70 per year (Billboard statistics, in Everest, 1975: 23-24). It was also during this period that the sound mixer, formerly considered to be no more than a technician or craftsman, began to take on the status of an "artist" in his own right (Kealy, 1979). This five-year period is also framed by what may be two landmarks in the history of popular musical practice: the 1967 release of the Beatles' album, "Sgt. Pepper's Lonely Hearts Club Band," which was certainly the boldest, most experimental use of the recording studio of its day; and the 1974 appearance of Disco, perhaps the first form of popular music never to have known an existence outside of the studio environment.

Unlike the "Solomon's Houses" of avant-garde electronic music, where quasi-scientific musical research could be pursued, at least for a time, without social or economic pressures; multitrack recording is central to commodity production in the recording industry. Commercial, as well as artistic success is a pressing concern of all those involved

in multitrack production. Multitrack recording technology, and the studio practices associated with it, were developed as an efficient way of meeting the aesthetic and technical demands of a particular kind of music—rock music. At the same time, the technology has helped to define rock aesthetics and has been instrumental in the reorganization of rock as a form of musical practice. Technological rationalization is thus at the heart of multitrack recording. Furthermore, greater technical mastery over the "sound" of popular music has, in some senses, also meant greater mastery over the social relations of production (domination of nature and man); with multitrack recording, popular music has become fully integrated with the technology in a single overall form of musical/technological production.

In some senses, it is difficult to apply the concept of domination to the multitrack studio: production often takes place outside the bureaucratic, institutional context of the recording industry itself, therefore only indirect constraints (financial, contractual, etc.) come into play, not direct control.<sup>1</sup> Nevertheless, a certain type of work routine is often encountered in studio production. The notion of "simulation" which I have proposed, with its emphasis on Habermas' concepts of "work" and "interaction," may be useful in understanding this new technologized production environment.

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<sup>1</sup>It has been argued that Weber's model of capitalist organization (i.e., bureaucracy) assumes a stable market system; but since the fall of Tin Pan Alley, the music business has been characterized by unstable, "turbulent" market conditions. This has apparently encouraged the rise of independent "entrepreneurs" who have taken over much of the production requirements of the industry (Peterson and Berger, 1971: 97-102). While this aspect of rationalization (bureaucracy) is reduced, I will argue that its complement, the "virtuoso," becomes embodied in the role of the entrepreneur whose methods may include other forms of domination.

In this chapter, I would like to examine the multitrack recording studio as a production environment: as a set of technological practices and an organization of musical labor. Multitrack recording is based on a combination of four practices: separation, overdubbing, signal processing and mixing. Separation and overdubbing will be discussed in relation to the organization of space and time (processing and mixing will be dealt with throughout the discussion). None of these practices originated with multitrack recording itself; the initial aim of multitrack was to extend, multiply and coordinate these various practices. A certain amount of historical background on the evolution of these practices will be useful as a means of understanding multitrack as a rational development of recording possibilities and goals. Finally, Chris Cutler's notion of multitrack as a democratic medium of "composition for performers" will be discussed in relation to certain myths of community in rock music.

#### The Studio I: Separation, A Question of Space

During the 1950s, notions of "High fidelity" and "Stereo Sound" were introduced into the field of sound recording (primarily in the recording of classical music, but later, in popular music as well). The concepts were related to the ability of a recording to give the listener an impression of two aspects of musical space: the first refers to the room where music is played; and the second, to the characteristic spatial configuration of a musical ensemble (Breh, 1982: 171-172). The latter is also related to loudness and musical balance (loud instruments are often placed at the back of a musical ensemble, soft ones, at the front). Loud sounds can sometimes appear to be closer to the listener than soft ones; thus, the introduction of dynamics in music has often

been equated, metaphorically, with spatial perspective in painting. It is the technical control over, and transformation of, these various spaces that is, in part, responsible for the "sound" of contemporary popular music as it has evolved through multitrack recording practices since the mid sixties. In this section, I would like to consider the development of the recording studio as a particular organization of space.

In the early days, sound recording was a relatively straight forward process: the musician or ensemble would be placed before a recording device and recorded direct to disc (or cylinder). Overall musical balance was achieved by the musicians themselves (as in a normal concert situation) but also through the spatial arrangement of the performers (which may have been markedly different from what they were accustomed to). Soloists or softer instruments, such as strings, had to be placed closer to the recording device than accompanying instruments or loud instruments, such as brass. Since no independent control over the individual performer's sound was possible, the privileging of certain instruments or parts in the musical texture was thus a matter of determining the proper spatial configuration of the ensemble.

Early sound recordings were made by the sheer force of the vocal or instrumental sound itself and thus almost required an exaggeration of the normal effort taken to project sound in space. The introduction of the electrical microphone, first in radio and later in phonograph recording, and the development of P.A. systems in live performance changed the terms of both sound recording and popular music practice. Firstly, the cramped and spatially distorted conditions in which recordings had been made could be returned to a more "natural" spatial configuration. Secondly, both in recording and in live performance, the musical balance between vocal or

instrumental soloist and ensemble could be altered and controlled technologically. Thirdly, the direct, spatial intimacy with which the microphone could be used brought about a new form of musical expression:

"Crooning was a style of singing made possible by the development of the electrical microphone--vocalists could now be heard singing softly--and the source of a new sort of male pop star (Rudy Valee, Bing Crosby, Al Bowly)" (Frith, 1986: 263).<sup>1</sup> The new technology thus offered three divergent possibilities in its use: it could be used as a corrective for previous technical inadequacies and allow for a return to a kind of musical status quo; as a means of technical intervention and control by a third party (the sound engineer); or as a creative tool extending the possibilities of musical expression.

In the early days of electrical recording the microphone was used sparingly. Only one or two microphones were normally employed (perhaps one to highlight a featured soloist, the other for the ensemble as a whole). The medium was still being conceived of and used in terms of the documentation of a musical performance. Beginning in the early 1950s however, recording engineers, with the aim of improving the technical quality of sound recordings, attempted to gain greater control over the recording process through a variety of means. John Eargle describes five techniques that developed during this period: 1) recording in acoustically dry studios; 2) the use of numerous, closely placed microphones to maximize separation; 3) the engineer's participation in the adjustment of musical balances; 4) the introduction of artificial reverberation

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<sup>1</sup>The microphone also created a new sense of intimacy between performer and listener (an illusion of the reduction of "space" between them). Hobart claims that crooning was advantageous to Tin Pan Alley in that the microphone gave emphasis to the melody over the instrumental arrangement (1981: 271).



which could be controlled by the engineer; and 5) careful selection, placement, and balancing of the individual microphones in the stereo array (Eargle, 1980: 64). Edward R. Kealy locates the development of these techniques, along with the emergence of rock 'n' roll, within the more general context of social, technical, economic and aesthetic changes of the 1950s: the introduction of television and the decentralization of popular music tastes; the replacement of disc recording by the cheaper, more flexible tape recorder and the attendant rise of small, low-cost studios run by entrepreneurs; and changing aesthetic expectations on the part of the audience for rhythm & blues and rock 'n' roll records (Kealy, 1979: 12-13).

There are three aspects of this development that I would like to address here. Firstly, there is the manner in which the various techniques and contexts outlined above contribute to an increasing technological rationalization of the recording process. Kealy argues that the "entrepreneurial mode" of production was less rationalized (in the sense of its bureaucratic organization and the specialization of roles) than the earlier "craft union mode" that was characteristic of the large recording companies at the beginning of the 1950s. While this certainly appears to be true, it only applies to one aspect of Weber's notion of rationalization (albeit an important one with regards to the capitalist organization of labor) as outlined in Chapter One of the thesis. But in other respects the entrepreneurial mode of production is extremely rational. Kealy points out that the development of the idea of the "hit sound" was "a conscious, aesthetic and commercial goal" (Ibid.: 13). I would argue that the organization of means--both technical and musical--were in keeping with this goal. As with Weber's notion of the earliest move-

ment towards rationalization in music, the entrepreneurial producer and the engineer might be considered as the "virtuosi" of this nascent art form and it is they who encourage technical experimentation (e.g., with novel microphone placements, complex mixing, artificial reverb, etc.).

Secondly, this form of rationalization strives for a technical mastery over the musical materials: both the instrumental sounds themselves and the space in which they are recorded (the latter contributes greatly to the overall coloration of the recorded sound). Through close miking (which, in the case of some instruments, can be within an inch) and signal processing (such as the manipulation of overtones through filtering, or "equalization") the engineer can change the character of an instrumental sound. When special effects are employed, the musician merely supplies the "raw material" for the engineer to manipulate; electronic instruments (like the synthesizer) are so fully integrated into the technical apparatus that no clear dividing line can be drawn between sound source and sound treatment (Schlemm, 1982: 153). While the instrumental sounds are seldom manipulated beyond recognizability (indeed, the aesthetic "enhancement" of sounds is considered as powerful as their distortion), the techniques brought to bear on the music by the pop studio engineer are, in essence, not unlike those of the composer of musique concrète.

With regard to the recording environment, all natural room resonances tend to be rejected in modern studio practice in favor of an acoustically "dry," or in the parlance of recording engineers, a "dead" space. The studio is rationally designed (through the use of sound absorption materials) so as not to have ambient resonances interfere with manipulation of individual instrumental sounds; again, as with avant-garde music of the same period, there is an attempt to acoustically isolate individual

sounds so that their characteristics can be more effectively controlled. Precise amounts of artificial reverberation are subsequently added to the sounds by the engineer. It should be noted that the aesthetics of "high fidelity," or "concert hall realism," were, in many instances, also achieved through multiple microphone set-ups and a precise balancing of direct and indirect (or ambient) sound. The difference between the two forms of technical mastery exhibited here can again be illustrated by reference to the aesthetic differences between musique concrète and electronic music as described in the previous chapter; whereas the one manipulates resonant sound information derived from natural sources, the other uses natural resonance as a model for synthetic production.<sup>1,2</sup> The degree of technical control that can be exerted over the latter is always greater than that exerted over the former.

Thirdly, and partly as a result of the technological rationality and the tendency towards domination of the musical and spatial elements outlined above, one can discern the beginnings of a technical mastery over the role of the musical performer in modern recording practices. For once the engineer and the producer take on the responsibility of musically balancing the recording they enter directly into musical practice. In effect, they take on the technical role of a conductor in forms of popular music (such as R & B, and rock) that never before had need of such a role. Unlike the conductor however, who in live performance directly "commands" the ensemble to play in a specific manner, the engi-

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<sup>1</sup>The analogy can only be carried so far, for in electronic music the object was not to imitate nature as in the case of artificial reverb.

<sup>2</sup>As with the avant-garde, the two schools of sound recording have few good words for one another: one engineer of the old school has referred to the modern studio as a "semi-anechoic sound-sink" (Hodges, 1980: 45).

neer and the producer do not necessarily have to try to influence the performer directly; instead, their interest and technical power can be focused on the isolated, objectified product of the musician's labor: the recorded music. Like the entrepreneurial conductor of the early symphonic era (as described in a quotation from Chanan in Chapter One), the producer/entrepreneur of the recording studio may also have certain contractual agreements with the performer that allow for a degree of direct influence as well. The question of roles will be taken up again in the conclusion of this chapter. For the moment, I would like to return to the matter of spatial separation and focus on the division and reconstitution of the musical ensemble through technological means.

In the studio, the spatial separation of the performers is reinforced by the use of physical barriers. These may take the form of movable, acoustically insulated walls ("baffles"); or, as in what has developed as a common practice in isolating vocalists from instrumental sounds, the use of small, separate rooms ("isolation booths"). This extreme form of separation is useful in making stereo recordings, not only because it allows the engineer to balance the dynamic level of the various sounds independently, but also because it allows the engineer freedom in the creation of different spatial arrangements of the sounds in the stereo field.<sup>1</sup>

Under such conditions, the ability of the musicians to play together as an ensemble can be subtly inhibited. Even advocates of separation recording have remarked on this problem:

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<sup>1</sup>As in so many recording studio practices, separation recording was first explored in the film industry. The music for Walt Disney's "Fantasia" (1938-39) was recorded by dividing the orchestra with baffles and recording the isolated ensembles on six separate sound tracks (Everest, 1975: 28-31).

As musicians are separated from each other physically and acoustically, something tends to be lost in the music in the effect the musicians have on each other. The intangible "something" that makes a group successful is undermined to a certain extent...Physical separation, extremely dead studio acoustics, opaque baffles, and isolation booths achieve channel separation all right, even to the extent that the musicians often cannot hear one another. (Everest, 1975: 20)

The technical solution to the problem of hearing one another is for the players to wear headphones in the studio; the apparent simplicity of this solution is deceptive. In any ensemble, some musicians will need to hear certain members of the ensemble more than others (e.g., in order to keep in time, in tune, in proper phrasing, etc.). For this reason, mixing consoles have been designed so that the "mix" in each player's headphones could be individually tailored by the engineer and kept separate from the "mix" destined to become the final recording. Thus, in order to play at all under the conditions of separation recording, the musical ensemble must become fully integrated into the technological apparatus--the apparatus is a mediating factor between all musical interactions in the studio.

As mentioned earlier, any musical ensemble displays a certain spatial structure: the symphony orchestra is an obvious example with its relatively standardized left-to-right distribution of high and low strings, its grouping of wind and brass sections, etc. The recording aesthetics of concert hall "realism" dictate that this spatial configuration be respected in the stereo mix (in large part, because the classical music consumer expects to hear it that way) even when the contingencies of the recording environment or an interest in creative experiment have caused the players to adopt a different seating arrangement from the normal one

(see Ross-Trevor, 1980: 125-127). By comparison, performing pop bands have been, as a rule, rather ad hoc groupings of musicians, varying in number and instrumentation; their spatial distribution is often dependent upon non-standardized club and concert venues. This fact, and the somewhat different expectations of the youth audience (Kealy, 1979: 13), allowed the producers and engineers of the early rock period to experiment and to develop their own rational approach to spatial placement in the recorded music.

Certain aspects of this rationality as it developed during the sixties can be noted. During the early part of this period as many as twenty-four microphones might be used in a pop recording session and, because no more than four tracks were available on most tape recorders of the time, a great deal of the essential mixing would have to be done at the time of the original recording (Eargle, 1980: 173); this severely limited the possibilities for further signal processing, balancing, and spatial placement in the final remix. Thus, certain calculations regarding the size and nature of the ensemble to be recorded, and decisions concerning track assignment were required before the session took place. Typically, the lead vocal would be assigned to one track, rhythm instruments (drums, bass and rhythm guitar) to another, and all other backing instruments and vocals to the two remaining tracks. Most often, in the final stereo mix, the vocal and rhythm tracks would be panned to the center position and the other tracks to the left and right (Ibid.: 191). There are musical and practical reasons for grouping rhythm instruments together (e.g. so that the players can function more efficiently as an ensemble unit under the conditions of separation recording) or for separating the vocalist from the other instrumentalists, etc., but this approach to recording is

also designed to meet certain aesthetic and commercial goals as well. For example, it is significant that the vocalist, who in popular music has always been one of the focal points of the star system and a privileged carrier of musical expression, was the only musician virtually guaranteed exclusive right to one of the four precious tracks and subsequently given "stage center," as it were, in the final mix.<sup>1</sup> It has been stated that part of the appeal of rock music derives not from the meaning of song lyrics themselves but from the "voluptuous presence of voices" (Frith, 1981a: 164). But while one may indeed respond to what Barthes (1972) called "the grain of the voice" when listening to rock singers, the sense of "presence"--the uncommon closeness with which the "grain" of the voice is revealed through the microphone--is the result of a rational technological process: the isolation, selective emphasis (through equalization, compression, reverberation and balancing), and spatial placement of the recorded vocal sounds.

In a similar way, the more recent multitrack treatment of the rhythm section allows for a selective emphasis on the "beat" of the music, which has also become characteristic of the "sound" of rock recordings. As mentioned above, early rock recordings usually devoted one of the four tracks to the rhythm section; while this allowed for a certain amount of general emphasis on rhythm, the overall effect was the creation of a dense, "percussive cloud" of sound (Hunter, 1987: 56). With 8-, 16-, and 24-track recording capability during the late sixties and early seventies, it was possible to record not only the vocal soloist but virtually all instrumental sounds separately and, later, to individually process and position

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<sup>1</sup>This early practice of devoting a separate track to a vocal or instrumental soloist is also common in mainstream pop and classical music recording (see Schicke, 1974: 214-215, 219; Ross-Trevor, 1980:126-127).

them in the stereo field. In practice, this meant that in addition to separating the bass and rhythm guitars from the drum kit, each individual component of the kit (snare, bass drum, cymbals, etc.) could be recorded on separate tracks; the number of tracks assigned to the drum kit alone often exceeded that assigned to any other part of the group (Nisbett, 1979: 244). Rhythm sections recorded in multitrack not only allow for a greater clarity and emphasis on the drum beat but also supply the engineer with an efficient means of tailoring the mix of rhythmic elements for specific commercial applications: this aspect of the multitrack recording process was especially important in disco music where different mixes (and different engineers in many cases) were used in creating radio and dance club versions of every tune (Joe, 1980: 48-49). The rationality of this approach to recording is complemented by a technical mastery over the percussion sounds themselves that is not unlike the kind of technical control exerted over the natural resonances of the studio environment. In the case of the drum kit, the natural ringing tones of the drums are usually dampened (through the use of blankets in the bass drum and pads on the snare and toms) in order to produce a more percussive sounding attack; this dampening is further aided by the use of devices known as expanders and noise gates which electronically shorten the decay time of each individual attack as it is recorded, thus "tightening" the sound of the drums (Woram, 1976: 155, 234-235). A ringing tone can then be re-introduced (if so desired) through the use of a tone generator and an expander (Ibid.: 239); as with artificial reverberation, the precise tuning and duration of the synthesized drum tone is entirely under the control of the engineer. The "tightened" drum sounds can be recorded at maximum intensity without interfering with the overall balance of the drum



kit or the ensemble as a whole. Once recorded onto several different tracks, the engineer must "reassemble" the drum kit into a spatial configuration in the final mix; this is usually done in such a way as to give the aural impression of sitting directly in front of the kit (that is, from a "listener's" perspective and not that of a drummer). This aural impression is distorted however in so far as the separation between the various components of the drum kit is much greater than that encountered under normal conditions. Not only are the cymbals and tom-toms spread over almost the entire breadth of the stereo field but they also become a spatial/structural framework within which the sound of the other instruments in the group can be freely distributed: in effect, the entire ensemble appears to play as if inside a drum set of almost mythic proportions--inside the spatialized rhythmic structure of the "beat" itself. Control over the sound of the drums is an object of such considerable concern within the overall technological rationality of multitrack production because, as with the sound of the voice, the "beat" is a major focal point in the commercial success of rock as dance music. The ultimate aim of separation recording then is technical control--technical mastery over the timbral, dynamic, and spatial characteristics of the music (see Everest, 1975: 20).

Generally speaking, the vocal and instrumental sounds recorded, processed, and spatially positioned in the manner described above do not fuse but rather, remain on essentially separate acoustic planes; the result is what we have come to know as the "pop sound":

current multi-track technique...creates the conditions for a sound separation, which makes for the characteristic "sound" of this type of music, by facilitating...[an] analytic penetration. In this way instruments and parts

with the most diverse sound volumes can be "processed" together to create an artificial tonality that is impossible to accomplish by conventional "natural" means. (Schlemm, 1982: 153)

In commenting on the aesthetics of multitrack recording and the impossibility of achieving the type of sonic blend characteristic of earlier, high fidelity recording aesthetics, one veteran engineer has described the pop sound as "multi-track mono... with a guy here, here, here, and there, and dead, empty nothingness in between, with no sense of environment, even if it's supposed to be a contrived environment" (Fred Catero, quoted in Hodges, 1980: 45; I make use of this comment here for its descriptive value and not its implied aesthetic judgement). To a certain extent, the sonic fragmentation that is characteristic of multitrack recordings can be regarded as both a result, and a reflection of, the spatial separation and isolation of the musicians in the rationally planned, acoustically dead environment of the studio. It is also the result of a shift in recording aesthetics away from the "realistic" documentation of a musical event to the creation of one. In this way, separation recording and multitrack mixing are an example of Walter Benjamin's well-known dictum: "To an ever greater degree the work of art reproduced becomes the work of art designed for reproducibility" (Benjamin, 1969: 224).

But the significance of this aesthetic in popular music practice goes beyond the confines of the studio and the recorded music that is a product of it, for pop bands often find themselves attempting to reproduce studio sound on stage. As a result, a sound mixer has become an indispensable member of most successful bands and a multitrack mixing console, racks of effects devices, etc., are among the band's most expensive musical "instruments." Audience expectation is not the only factor at play

here, for the musicians themselves have developed musical values that led to the adoption of the new technology. There are perhaps two reasons for this: firstly, rock music has been, from the outset, a highly technological form of popular music with a dependence upon a variety of electronic devices including electric guitars, keyboards, etc.. The adoption of mixing consoles in live performance is, in part, an extension of the general technological orientation of the musical practice. Secondly, and more importantly, rock, as with other forms of folk and popular music, is transmitted aurally: in the process of learning songs from radio and recordings popular musicians have developed a "recording consciousness" (Bennett, in Kealy, 1979: 15). As a result of this process, rock has become a curious mixture of rational and irrational elements: a set of musical materials (chords, melodic devices, etc.) that are traditional and/or expressive; and a technology (multitrack consoles, etc.) whose use is oriented towards rational decision-making and control (it should be noted that the early technological instruments of rock, such as the electric guitar, which allows for a direct, expressive manipulation of musical materials through the bending of strings, the use of feedback and distortion, etc., are of an entirely different technological order from that of the multitrack console, which requires a more abstract method of operation). The technological apparatus is thus not only a mediating factor between musical interaction in the studio, as was mentioned earlier, but also in live performance and (at least implicitly) in the musical learning process as well.<sup>1</sup>

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<sup>1</sup>Recordings have been an important factor in the lives of self-taught popular musicians since the early days of this century (see Jones, 1963: 101-102; and Williams, 1980); however, it could not be said that the technology itself had penetrated so deeply into musical practice.

Multitrack recording technology and the practices associated with separation recording vastly expanded the possibility of technical control over the sound of popular music inside and outside the studio, but another aspect of multitrack studio practice has perhaps had an even more profound impact on popular music-making: the separation of musicians in time. Through the technical practice known as "overdubbing," multitrack recording reveals itself not only as a rational means for the production and transformation of sound material, but also as a rational means for the organization of work.

#### The Studio II: Overdubbing, A Question of Time

The flow of time is perhaps music's most essential element—even more so than sound itself;<sup>1</sup> and rhythm, is its most powerful organizing principle, both musically and socially.<sup>2</sup> The development of a relatively precise form of notation constitutes Western music's first break with time: it provided for a spatialized representation of time (and pitch) and a means for the rational planning of large-scale musical works outside of actual, real-time performance. The advent of sound recording was the second break and a much more startling one; for through sound recording it was possible to capture the ephemeral moment of musical performance

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<sup>1</sup>Even before discovering that there is no such thing as silence in any human, perceivable sense, John Cage had declared that "duration is the only characteristic of sound that is measurable in terms of silence, therefore any valid structure involving sounds and silences should be based not as accidentally traditional, on frequency, but rightly on duration" (Cage, 1973: 13).

<sup>2</sup>In the West, the musical metaphor for collective social action has always been "harmony." John Blacking has suggested that in African music rhythm is both a musical and a physical expression of concepts of community and social balance (Blacking, 1973: 30).

itself and to make it repeatable. With magnetic tape the temporal continuity of a work could be broken and then reassembled through editing but still, each edited segment had to be recorded as an integral performance by whatever number of musicians demanded by the music. Through the process of overdubbing however, it became possible, for the first time in musical history, to assemble a recorded performance one part at a time--to layer and synchronize the contributions of individual musicians into a single musical/temporal experience. Used in this way, multitrack recording technology can, in effect, become a meeting ground for compositional and performance art or, as Chris Cutler has stated: multitrack recording can be "a medium of composition for performers" (Cutler, 1985a: 143). Cutler has also stated that this new form of compositional/performance can (or should) be a collective form of activity (Ibid.). I would argue the opposite however because, by breaking the essential time-bound character of group performance, overdubbing tends to emphasize the individual contribution over that of the collective. Overdubbing creates a "simulation" of collective activity, thus interrupting what Habermas might refer to as "communicative" action by substituting in its place a "work" discipline. Group performance itself undergoes a process of rationalization and this process is encouraged by the commercial context of production. It is the development and impact of this process on musical performance as a time art that I would like to discuss here.

Some of the first experiments in overdubbing were carried out by the well-known guitarist Les Paul during the late 1940s.<sup>1</sup> As with Pierre Schaeffer's work in musique concrète of the same period, Les Paul began

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<sup>1</sup>In a limited sense, overdubbing had been used in the film industry since the early '30s in the form of post-sync dialog, effects, etc.

his experiments with two disc cutting lathes, copying from one to the other and overdubbing new parts as each copy was made. During the late 1940s and early 1950s Paul released several hit songs (with wife and singer Mary Ford), some with as many as 24 instrumental and vocal parts built up in this manner. Following this work, he created the specifications for the first 8-track tape recorder, which was built for him by Ampex corporation in 1952 (Sievert, 1978). Paul's early technique is more accurately referred to as "sound-on-sound" than overdubbing (in the multitrack sense of the term) in that once recorded, the individual parts could not be erased, rebalanced, or otherwise altered. The technique required a high degree of rational planning: the whole song had to be completely arranged, in every detail, in order to avoid ruining the previously recorded "tracks." The move to multitrack tape was itself a rational decision based on the possibility of eliminating the element of risk that was an inherent part of the earlier disc recording technique.

Les Paul's approach to recording was, without doubt, a form of composition, a literal "putting together" of the music. But the connection with traditional composition goes deeper than this. In the introduction to the Philosophy of Modern Music, Adorno states that in the composition of music, especially polyphonic music, the composer posits a "we" when, in reality, he expresses only himself as "I." The composer cannot say anything without first positing the collective "we" and this is the source of both a creative moment and a contradiction in all composed music (Adorno, 1973: 18-19). Through Les Paul's use of overdubbing the "I"—the composer/performer—is technologically transformed into a "we" in recorded form. The recorded performance that results from this process thus partakes of both the creative and the contradictory elements of com-

position. Les Paul's innovative use of recording technology is in keeping with Chris Cutler's notion of the possibility of a fusion between composition and performance; it points towards a new balance between rational and irrational forms of behavior in popular music production.<sup>1</sup> Ironically, what appears to be among the most creative uses of the technology is also the least collective in nature.

These contradictions became much more evident when the technique of overdubbing was introduced into the dominant social and economic context of the popular music industry. For here, the technique became part of an overall technological rationalization in which time, and money, were of the essence:

In the early days of magnetic tape recording, recording engineers discovered that singers or instrumental soloists who worked slowly under studio conditions, or who were prone to frequent mistakes, could be recorded much more efficiently and economically through a process called "over dubbing." In order to avoid keeping musicians on hand in the studio while the singer or soloist struggled to make the right takes, the wise producer learned to record the orchestral accompaniments separately. The artist, ...could then be brought to the studio, where, with the aid of earphones, he could sing or perform along with the tape of the orchestral track. Next, both the prerecorded track and the newly recorded track were combined on a single tape. (Schicke, 1974: 155)

For the recording industry, overdubbing was not so much a creative tool as a rational means: efficient and economic. It was also a means of propping up the star system (and this was as true for rock 'n' roll as it was for early '50s pop): it ensured that the lead singer always sounded "right" no matter how many takes might be required.

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<sup>1</sup>The potential for performer self-awareness and musical growth through the use of multitrack technology has even been recognized by jazz pianist, Keith Jarrett, who has maintained a long-standing opposition to electronic musical instruments (see Doerschuk, 1986).

The development of "selsync" (which allowed for the coordination and synchronization of any number of tracks) offered a greater level of flexibility in overdubbing than was possible during the early fifties. The commercial successes of sixties rock producers such as Phil Spector were, in part, based on the creative possibilities available through the use of 4-track recording equipment and overdubbing. With the expansion of multi-track during the mid sixties however, it could be argued that the recognition of the economic advantages inherent in overdubbing was an equally important factor leading to the adoption of the new technology. The following comments, first published in 1967, were made by an engineering advocate of multitrack recording and are indicative of this general attitude:

recording on the multi-track machines can be economical. One or more tracks can be recorded independently of each other...In this way a few performers proficient on several different instruments can be used, eliminating the need for a large group, yet achieving the same results. (Alexandrovich, reprinted in 1983: 40)

Thus, in a system where labor is always an object of rational calculation, the technical mastery of musical time (the domination of nature) becomes synonymous with the technical mastery of labor relations (the domination of man).<sup>1</sup> The ability to play on several different instruments (which, as mentioned in Chapter Two, was considered by Kurt Weill as one of a jazz performer's most valuable musical skills) has now become a matter of economic survival for many session musicians.

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<sup>1</sup>The degree to which overdubbing can be used as a means of rationalizing labor costs varies greatly from one country to another. In the United Kingdom, the musicians' union has actually made it more expensive to use overdubbing in some applications (e.g. such as using a single violinist to create the sound of an entire string section). In North America, musicians are paid on the basis of a flat, three-hour fee (plus doubling fees when required) no matter how many overdubs are made.



Interestingly enough, for the recording of the average rock band (if no additional session musicians are to be used), overdubbing is relatively inefficient in terms of time and money: it takes much longer to record a song one part at a time than it does to record an integral performance of it several times over. The aesthetic and commercial goal of achieving the right "sound," as discussed in the previous section of this chapter, comes into play here for even greater precision in timbral and dynamic control can be had through separation recording in conjunction with overdubbing (overdubbing allows for individual attention to each recorded part and the deferral of large decisions concerning balance and further processing to a later, more relaxed mixdown session). Thus, time and cost efficiency is exchanged for greater control over the recorded musical materials.

The domination of musical materials achieved in this way, however, requires the simultaneous subjection of the musicians to a rationalized work discipline. I would like to characterize the nature of that discipline by referring to Habermas' categories of "work" and "interaction" as outlined in Chapter One of the thesis. In a sense, musical performance, especially group performance not based on strictly notated structures, can be conceived as a form of "communicative action": a form of "interaction" governed by consensual norms and reciprocal expectations that are understood and recognized by the members of the performing group. In multitrack overdubbing the fragmentation of temporal relations which are only later technologically synchronized (i.e., "simulated") transforms interaction into "purposive-rational" action, or "work": the realization of defined goals through a specific organization of means and strategies. To put it into simple terms, it is impossible for a musician to interact,

to communicate with a prerecorded track ~~is~~ that it is impossible to change the course of what is already there. Thus, musical performance in the multitrack studio takes on a new character: it is no longer "interaction," but only reaction.

Certainly, I do not wish to imply that musicians, in live performance, are likely to change the course of a musical performance in any radical way (although this is always possible and sometimes does occur in the freer forms of jazz). Rock music has its own rational chordal, metric, and lyrical structures without which performance could not take place at all. I am concerned here with a much more subtle aspect of the dynamics of interactive musical behavior; the interruption of this dynamic is perhaps the first step towards greater automation in popular music production, as I will attempt to show below. First however, I would like to address what appears to be a tendency among some writers to disregard the mediated nature of musical relations in multitrack studios, a failure to differentiate, as I have done here, between "interaction" and "work."

In Chapter Two, I cited Trevor Wishart's comparison of the spatialized concept of time found in musical notation with that of Bergson's concept of the "uni-directional continuum" of experience. After his condemnation of "scribal domination," Wishart concludes his essay by extolling the virtues of multitrack sound recording as an "unmediated" experience:

in jazz, the group achieves a democratic solidarity in the immediate dialectic of their performance experience, which may, however, be further refined in the recording studio by repeated attempts to musically "act" the new track in immediate response to the tracks already laid down. (Wishart, 1977: 150)

The "democratic solidarity" achieved by the jazz group arises out of the uni-directional continuum of performance experience--an experience that is characterized by interactive communication. Such an experience cannot be "refined" through multitrack recording because the inherent repeatability of tape destroys the uni-directional continuum of time and substitutes predictability for solidarity. To respond to a prerecorded track can certainly be considered as a musical "act" (I do not question this aspect of Wishart's statement nor its implied pedagogical intent). However, it must be realized that such an act is quite different from interactive musical performance practice as it has been traditionally known throughout jazz history; such an act is musical in the same sense that composition is musical: as an act that is primarily rational and non-interactive.

In a recent article, Mark Hunter adopts a point of view which is similar in general outlook (though not in its detail) to that which I have argued here. He notes three significant aspects of performance practice in rock music that have been affected by multitrack recording. The first concerns "ensemble spontaneity"; he states that in live performance, musicians

adapt their individual intensity and attack to one another's work, moving in and out of the lead as the moment demands. In multitrack work, where musicians take turns recording their parts, it is nearly impossible for an individual player to alter the ensemble's direction in this manner. A mistake will sound like a mistake, instead of a cue for the rest of the ensemble to incorporate an accident into a large effect.  
(Hunter, 1987: 55)

It is interesting that Hunter focuses here on "mistakes" rather than on any supposed intentional changes in musical direction. As noted earlier,

rock performances are certainly not "spontaneous" affairs; they are structured and rehearsed in every detail (even Darius Milhaud's enthusiastic remarks concerning musical expression in early jazz (quoted in Chapter Two) were tempered by the knowledge that this music too underwent elaborate, daily rehearsals; see Milhaud, 1967: 36). Ensemble spontaneity then is not so much related to the manner in which an ensemble plays what it intends to play as it is to the manner in which the players respond to that which cannot be rationally planned for.

Secondly, Hunter notes that the performance of a song creates its own unique "dynamic flow." But when recording isolated phrases of a song as is usually the case with overdubbing, or when correcting mistakes in certain passages musicians, especially singers, tend to adopt a single, uniform dynamic level; the result is a kind of dynamic flatness that seems to be characteristic of many recordings of popular music today (Hunter, 1987: 56). While I would agree with Hunter that overdubbing would appear to encourage this type of performance on the part of musicians, it should also be noted that some of this flatness may be the result of the intrusion of engineers into the process of achieving musical balances in separation recording.

Thirdly, and most importantly for my purposes here, is the question of "rhythmic invention." In multitrack recording the first tracks to be laid down are the rhythm tracks (either drums alone or with bass; sometimes electronic "click tracks" are also used). This is necessary in order to set a constant beat: the temporal/structural frame that will be used to synchronize the other parts that will be recorded later. Hunter argues that rhythm, once a domain shared by most, if not all the members of the rock group has now effectively become the province of one, or at

most two players who "are obliged to play in a way that will not complicate the recording of subsequent tracks...Rhythm, once the backbone, has simply become the flat bottom" (Ibid.).

Thus, the rationalized work routine imposed by overdubbing creates, or reinforces a hierarchy among the members of the rock band. Within this hierarchy, those who are recorded last (as usual, the vocalist, or a featured soloist) have the greatest degree of expressive and improvisational freedom; those who are recorded first, tend to be the most constrained in this regard. It is ironic that while the "sound" of the drum kit has, as described earlier, become so enhanced through separation recording, the role of the "beat" itself has simultaneously lost much of its flexibility--it has lost its power to push and pull at the flow of time, to articulate rhythm in a musically expressive way. In multitrack recording practice, the drummer is often reduced to the role of time-keeper. Not surprisingly then, with the appearance of Disco and increasing technological innovation during the early 1970s, the drummer was the first to disappear from the studio: the "beat"--the feel of the music--was replaced by the "sound" of the drum machine.

The three elements described by Hunter and outlined above--ensemble spontaneity, dynamic flow, and rhythmic invention--are among the very subtle, expressive aspects of interactive musical performance practice that are interrupted by the technical process of multitrack overdubbing. In Weber's study of music he traced the manner in which increasing harmonic rationalization in Western art music had tended to rigidify tonal intervals (by eliminating microtones, melodic inflection of pitches, etc.). The rationalization of temporal relations between musicians through technology and technological practices appears to have a similar rigidifying

effect: not so much on the musical materials themselves as on the dynamics of musical performance, that is, on music-making in its temporal domain. Again, as with separation recording, the effects of this technical practice are not confined to studio production alone; it is not uncommon today for pop bands to synchronize their playing to prerecorded backing tapes in live performance, thus extending the concept of overdubbing (and its various constraints) to musical performance in general.

The elements outlined above are, admittedly, quite subtle, but by no means insignificant. To attempt to understand them in musical terms only however, would be to adopt a hyper-aesthetic attitude towards a musical form where such an attitude is quite out of place. The significance of these interactive aspects of group performance and their inhibition by multitrack recording lies not in their intrinsic musical value alone (my argument here is not that of Hunter, who would have us believe that pop music is no longer worth listening to; *Ibid.*: 57); their significance also lies in the fact that they are aural signs of a much larger shift in the nature of popular music-making, a shift that has already been hinted at above in the section on separation recording: the full technical integration of popular music practice with sound recording as a commodity form.

In order to make this point clear I would like to recall some of the remarks made concerning popular music in Chapter Two of the thesis. There I quoted Hobart's argument that, in Tin Pan Alley pop, notation served as both a commodity form—sheet music sold to the public—and as a technical means through which capital intervened at the point of the production of music, as a technical means of ensuring standardized performance through notated arrangements. Thus, notation played complementary roles in music at the moment of its production and at the moment of its consumption.

During this period, radio and disc recording gave country, blues, and other forms of popular music not based in notation a wider distribution and acceptance than they had previously enjoyed. While this event marked the beginning of a more or less full economic integration of these folk musics with the industry based on the new commodity form--sound recording--the technical integration of musical performance had not yet been achieved. Certainly, capital intervenes in musical performance practice in a variety of ways; financial and contractual pressures can, and do constrain popular music-making: "The one thing Jazz performers have never been able to do is exercise a choice of audience... When I perform in a club, I am playing for the manager of that club" (Ornette Coleman, in Hobart, 1981: 263). But aside from these types of intervention, sound recording, unlike notation, presented no direct means of access to musical performance. As long as the sophistication of sound recording technology and practice remained at a relatively low level, and as long as the aesthetics of recording were based in the idea of documentation, popular music-making remained largely in the hands of the musicians.

It was in this context that R & B and rock 'n' roll gained popularity during the 1950s. The rise of rock 'n' roll was especially dependent upon sound recording and radio broadcasting but the music itself was still considered a performers' art:

Cosimo [Matassa] devised a simple formula for rock recording similar to that used by George Goldner and other early producers: set the dials at some sensible level, turn on the tape machine and let the performers wail. Either one caught the sound live or one did the song over again until it was right. No overdubbing, no electronic manipulation (other than an occasional echo or sound effect) was ever utilized. In the Fifties, performers like Little Richard and Ray Charles flocked to Cosimo's studio in search of that marvelous sound

which came from the New Orleans sessionmen, the acoustics of the room and the simplicity of Cosimo's control board. (Winner, 1980: 38)

The emphasis during this period was clearly on the music, which was the result of a musical/social "interaction": that between a dynamic, star performer and a group of session musicians who were experienced and had a specific style of playing. This aspect of local studio production is, to some extent, still recognized by recording companies, but it was during the fifties that this quality of "interaction" was especially important to the music: "outlying studios often had a local flavor not attainable in New York or L.A. Session players with less standardized techniques were available, for instance" (Chapple and Garofalo, 1977: 178). The "sound" of the recording on the other hand, was the result of the "simplicity" of the technology--a room, a control board and a tape recorder--and a recording aesthetic of non-intervention: "let the performers wail."

In contrast, the so-called "Spector sound" of the early sixties was the result of massed rhythm sections elaborately overdubbed with vocals, brass and string arrangements. The music and the "sound" were not so much the result of a musical interaction as that of a single vision--a vision that has been described as "Wagnerian" (Brian Wilson, in Ibid.: 79; see also Cohn, 1980). With Spector, rock 'n' roll became a producer's art: the practice of making music became virtually synonymous with the making of records, with the making of a "hit sound" in the studio. It is interesting to note that this technical incursion into music-making was accompanied by a latter-day revival of Tin Pan Alley-style song production: the composers and lyricists at New York's Brill Building churned out the material that Spector, and producer's like him, would then turn



into hits (see Shaw, 1980: 120-128). A similar formula was adopted by Berry Gordy when he established Tamla Records (and later Motown) in 1960. Gordy's operation coordinated the efforts of musicians (mostly vocal groups), writers and producers; the vocal groups were as much the vehicles for the creative efforts of the writers and producers as musical entities in themselves (McEwen and Miller, 1980: 235-248). The multi-track studio of the early sixties was made part of an overall rationalization of production that was manifest in "The Motown Sound":

Motown was a highly organized record company. "A factory-type operation," Gordy called it. To many the Motown sound of the sixties sounded similar on every record. "They have invented the Volkswagen body and there isn't very much that can go wrong with it," said Phil Spector. Motown music was designed and mastered for three-minute radio exposure. (Chapple and Garofalo, 1977: 88)

Thus, with the initial development of multitrack overdubbing and the accompanying shift in production aesthetics, sound recording was technically integrated with musical practice in a new way: as with notation during the Tin Pan Alley era, sound recording could now play a set of complementary roles in popular music that would embrace the moments of production, promotion (Top 40 airplay) and consumption.<sup>1</sup> It is perhaps significant that this development took place during a period (albeit a brief one) when rock music was becoming increasingly rationalized, when specialization and standardization were becoming the norm of popular music production.

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<sup>1</sup>I have expanded Hobart's analysis of notation and sound recording as commodity forms here in order to include the third "moment" of promotion--the moment where commodities are mediated by the marketing strategies of the industry. The analysis of the cultural significance of commodities according to such a scheme is outlined in Hebdige, 1981: 45-46).

By the late sixties, much of this had changed however: early sixties pop was displaced by rock and the more successful rock groups began to obtain considerable amounts of creative control over their recordings. In return, the record companies expected greater professionalism from the groups (Frith, 1981a: 108). But rather than pursue these developments in great detail here, I would like to broaden this discussion of studio practices so as to address certain aspects of rock and technology as ideologies.

The Beatles are often credited as having been a major force in the revival of rock 'n' roll during the sixties. Along with other bands, they also reordered the relations of pop music production: unlike the pop vocal groups of the early sixties, the Beatles were a self-contained production unit, writing and playing their own songs. In their early recordings (produced by George Martin), they developed their own "sound" by adopting many of the recording techniques (but not the characteristic division of labor) introduced by Spector and others.

It was during the late sixties however that the Beatles, together with Martin and engineer Geoff Emerick, were to bring pop music to even greater levels of integration with the medium of sound recording than had Spector. In 1966 the Beatles played their last live concert and, much like the classical pianist Glenn Gould had done two years earlier, they then retired to the recording studio to explore what seemed to be its limitless possibilities. The 1967 appearance of "Sgt. Pepper," in effect, solidified that decision: they were now making music that could no longer be played live. "Sgt. Pepper" was a self-conscious, even "arty" product of the studio—a product which took 700 hours to record and represented a new level of collaboration between the Beatles, Martin, and Emerick. With "Sgt. Pepper" and other albums during the late sixties they pushed

pop recording techniques to their limit and even borrowed a number of techniques from musique concrète: backwards sounds, the extended decay of the piano chord in "A Day in the Life," and the tape collage of music and sounds in "Revolution 9."<sup>1</sup> "Sgt. Pepper" was considered as the first example of a collective "art" of studio production: band members, producer/arranger and engineer all exploring the total musical and technical possibilities at hand. It was a form of composition where (instead of an "I" positing a collective "we") a "we" affirmed its own existence through the process of composition itself.

Ironically, a year later when they produced the white album entitled simply "The Beatles," the group had already begun to disintegrate and, as is well known, the members of the band were seldom all in the same studio at the same time. The group had to be held together, as it were, through overdubbing by Martin and Emerick. The process of composition was thus, in a sense, reversed: the communal "we" of the group had become little more than a series of spatially and temporally fragmented "I" statements technologically assembled after the fact by a producer. In rock music, "Groups are images of community" (Marcus, 1975: 44). With the recording of the white album in 1968, the Beatles, as a group, became a myth, which is not to say that they became a "lie"; but rather, they became an imaginary community, the only evidence for the existence of which lay in the recording itself.

The myth of the "group" as model community is a powerful one in pop music. It is part and parcel of the image that the group creates for

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<sup>1</sup>"Sgt. Pepper" also appears to have pushed the "art" of promotion to its limit. Greil Marcus has described the "event" that accompanied the release of the album as "the most brilliantly orchestrated manipulation of a cultural audience in pop history" (Marcus, 1980: 183).

itself and may be little more than the projection of comradeship (Ibid.: 72). But it is perhaps also a necessary corollary to that other myth of community, that which is supposed to exist between the rock group (or star) and the audience (see Frith's discussion of the ideology of folk music in rock in 1981a: 48-52; and 1981b). The various shifts in the career of the Beatles during the late sixties underline a fact that has become increasingly evident since the introduction of sound recording over a century ago: that live performance, as an integral part of musical practice, has become something akin to what Raymond Williams refers to as a "residual" form of cultural activity.<sup>1</sup> Indeed, since the introduction of multitrack overdubbing, live performance has become more or less functional: for the recording industry it is simply a means of promoting the sale of records; for the rock groups (and their audiences as well) it is the moment in time when they can most directly respond to one another, it is a means for keeping alive the myth of community.

It is a similar kind of myth that lies at the root of Chris Cutler's argument (mentioned briefly at the beginning of this section) concerning popular music and the multitrack studio. His argument recreates the myth of community and, more important to the study at hand, he combines it with a myth of technology. Cutler wants to see the possibility of "collective" work in the studio as a model of community—a model of the "classless society." His argument is a curious mixture of Marxian class analysis and a McLuhanesque technological determinism (with a strong emphasis on the more utopian aspects of both): "the innate qualities of the

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<sup>1</sup>In his description of culture and shifts in style or practice, Williams uses a typology of "dominant," "residual," and "emergent" forms; Williams, 1977: 121-127). While his use of these terms is more precise than mine, the term "residual" nevertheless seems appropriate to this context.

new medium of production [multitrack recording], which are collectivist & democratic, can only be creatively developed by a democratic & collectivist class, a class whose historical role is to end class division altogether" (Cutler, 1985a: 147). Cutler supports his claims concerning the "innate" qualities of multitrack recording through a formal analysis of three historical "modes" of music-making. The analysis is based on the "medium" of production and reproduction in each mode: the "folk mode" is based on human, biological memory and is transmitted via the ear; the second mode (most fully developed by the Bourgeoisie) is based on notation and is transmitted via the eye; the third, the mode of contemporary popular music, is based on the medium of sound recording and is transmitted, once again, by the ear (Ibid.: 133-144; the implicit similarity of his analysis to the work of McLuhan is made explicit by Cutler in Ibid.: 147). For Cutler, notation negates biological memory, the eye negates the ear, and bourgeois individualism negates the folk community. Sound recording, as "the negation of a negation" ("recording is memory of sound," it defines music, once again, as an art of the ear, it "can become a collective activity"; Ibid.: 142-143; all emphasis is Cutler's), has brought us to the frontier of the promised land: "indisputably, intrinsic to the processes of recording & electrification are revolutionary imperatives" (Ibid.: 142). The only barrier that stands in the way of these imperatives and the possibility of their coming to fruition is the commercial interests of the Bourgeoisie.

There are many inadequacies in Cutler's analysis and the naive, twisted dialecticism that forms the basis of his conclusions. But what is of interest here is the manner in which technological innovation is made to imply, and is indeed conflated with, social progress. As des-

cribed in Chapter One, Leiss has pointed out that such a confusion is characteristic of the modern response to technology, it is a widespread attitude that lingers on as one of the results of the initial formulation of modern scientific philosophy by Francis Bacon during the seventeenth century. Granted, Cutler does attempt to place technology within an overall social and economic context; but he views that context as an external force that distorts the "innate," the "intrinsic," the "revolutionary" character of the technological form itself.

In the discussion of separation recording and overdubbing presented above, I have attempted to follow Raymond Williams' approach to technology by analyzing it not only in its form but also as a set of "intentions" and "practices." Seen in this way, the uses of multitrack technology are manifold and at times contradictory, but no one use can be considered as more "intrinsic" to the technology than any other. Commercial interests do not so much "distort" the technology as place selective emphasis on certain uses over others, thus narrowing the apparent field of possibilities. Furthermore, sound recording does not "negate" notation (anymore than an ear "negates" an eye: most of us live with both and for good reason). As I have shown above, multitrack overdubbing and notation can, and are used together as complementary means in an overall strategy of rationalization in commercial sound production.

The Baconian confusion—that between the domination of nature and the liberation of man—also manifests itself in Cutler's concept of musical performance. In an article restating his basic historical thesis, Cutler argues that jazz is perhaps overly concerned with improvisation, performance skills and real-time collective composition and, as a result, it only makes use of the recording studio as a "documentary" device:

"In these crucial respects it is time-locked, tied to real, linear time --and of course one of the prime attributes of the studio is that it liberates performance from this constraint" (Cutler, 1985b: 29).<sup>1</sup> But of course, improvisation and performance practice as such have no real need of being "liberated" (in the same way that sound did not need to be "liberated" by Varèse and his composing machine). Cutler confuses the "liberation" of performance practice with the technical possibility of mastering it through overdubbing (in this way Cutler and Varèse have much in common, they both conflate technical mastery with the idea of musical "progress"). The fact that rock music is more fully integrated with the multitrack studio practices of signal processing, overdubbing, etc. (see Ibid.), does not make it any more likely to achieve a "liberated" form of musical practice than jazz or any other "avant-garde" music (Cutler states his affinity for the aesthetics of musique concrète in 1985a: 100).

Certainly, the musical character of improvisation, and musical practice in general, does change under studio conditions: it becomes, in effect, more rationalized. Just as chordal harmony creates a rational, structural framework for expressive, melodic elaboration; the multitrack studio creates a meta-structure for a rationalized, test-and-evaluate form of musical practice. That is, even when it does not lose its essentially expressive, affective character (as it seems to do in the case of rhythm, etc., as noted earlier), performance becomes a kind of calculated risk-taking in a no-risk environment (the ability to erase an individual performer's "mistakes" eliminates any possible "secondary effects" on the

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<sup>1</sup>In general, Cutler's assessment of the conflict between jazz aesthetics and multitrack practices is correct. For an interesting example of the aesthetic balancing act that seems required of jazz players when they make use of overdubbing see Milkowski, 1987.

recorded music as a whole). But it is precisely this type of rationalization of performance practice that Cutler hopes to achieve through multitrack recording. It is the deferral of decision-making that transforms performance into composition: "constructive decisions in the assembly of sound are concrete & empirical & can be reached through discussion" (Ibid.: 143). Thus, Cutler's "liberation" of performance practice requires that it no longer be considered as an adequate form of "collective" (or "interactive") musical behavior: performance must be transformed into "work" so that "collective" decision-making can be achieved, rationally, within the realm of language (I do not mean to imply that musicians do not make use of language, indeed, musical interaction and interaction through language are complementary; but in Cutler's model of composition, the affectivity of group interaction in the former is technically interrupted so that the rationality of the latter can predominate).

Despite his utopian vision of the "historical role" that popular music (in conjunction with the new technical means of production) is destined to play, the obstacles that seem to confront Cutler are no different from those that confront any other so-called "independent" producer who is simply trying to "make it" in the industry. There are problems of access to studio time (which is essentially a problem of money) and access to specialized knowledge (see Cutler, 1985b: 30); and there are problems of distribution and marketing (Cutler, 1985a: 102). The only advantage Cutler or any other "independent" may have in overcoming these obstacles is the possibility of creating a unique form of musical "content," a new "sound," or perhaps even a new kind of "music" that will capture an audience, that will, in effect, create its own "community." But in most other respects, the industry has a distinct advantage: for in so far as



rock music is integrated with recording technology, it is the technology which will, in part, set the terms of the competition. After the initial expansion of multitrack technology during the late sixties and early seventies, the actual number of studios began to decline. The cost of keeping up with the rapid development of the technology (not simply the recording equipment but all the auxiliary devices as well) and changing fortunes within the industry as a whole made it impossible for all but the most commercially successful to survive (there has been, of course, a development in low-budget, semi-professional recording equipment as well but the dividing line between the two levels of technology, and the musical activities associated with them, has been clearly drawn within the industry). To a certain extent then, capital is in a better position to take advantage of the new technology; it has a greater capacity to develop, expand, and organize the technical means of production (at least indirectly) in order to meet its own interests.

Multitrack recording is a form of technological rationalization-- a purposeful organization of tools and techniques--and it is also a form of mastery--it organizes and transforms sound, labor, space and time. In multitrack recording, space and time are not abstract, they become, in effect, material objects to be mastered. Nor are they separate dimensions. Technical mastery of one reinforces technical mastery over the other and it is through such mastery that the materials and practices of music are themselves mastered:

Multitrack recording offers the ability to conquer space and time by building up a group effort piece by piece. For example, an acoustic guitar and drums could be recorded on separate tracks on Monday when these performers are available. Then, in overdub sessions, other guitars might be added on Tuesday, bass on Thursday...In each overdub session, headphones

carrying a temporary mix of what has been recorded supply the performer with necessary timing cues.

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 It is also possible to accommodate the schedules of expensive talent by shipping tapes across the country to add a few tracks of big-name performers. For example, in 1974 Apple Records released the album "Ringo," enlisting the services of all former members of the renowned "Beatles" group. They recorded some of the tracks with Ringo Starr, John Lennon, and George Harrison in Los Angeles, and then Mr. Richard Perry took the tapes to London, where he recorded Paul McCartney. Returning to L.A., the remaining tracks were recorded and the whole thing mixed down for release. (Everest, 1975: 20, 117)

The technical mastery of space and time does not only contribute to the rationalization of sound production, it can also contribute to the creation of a myth of community.<sup>1</sup> Ironically, the sonic "image" of community in recorded music is created through a technical and musical practice which has little in common with any spatial, temporal or social concept of "community," but has much more in common with the general nature and organizational patterns of production, promotion and distribution within multinational capitalism. Thus, the "simulation" of musical performance practice in the multitrack studio has a significance that goes beyond the actual production process itself, a significance that touches upon questions of power and ideology in consumer society.<sup>2</sup>

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<sup>1</sup> At times, the creation of a group of musicians as an "image" of community can be quite intentional in pop music. Prince is reported to have made a video clip that shows him leading a band in a lip-sync "performance" of a song which he had actually recorded alone, through the use of overdubbing, in a multitrack studio (Gehr, 1983: 39).

<sup>2</sup> It has already been suggested that the myth of community is of use to the industry in so far as it helps to promote the sale of records. To pursue the notion of "community" as a more general ideology in society would require a closer examination of consumerism, rock audiences, etc., and this would go beyond the scope of the present study.

## Conclusion

Many forms of music in industrialized countries have, since the advent of sound recording, been more or less economically integrated with the music industry (the degree of integration varies greatly, and can vary with time). Certain forms, however, make considerably less use of the technology of sound production than rock; indeed, as noted in this chapter, Chris Cutler has criticized jazz for relying on its traditional modes of performance rather than making its practice more integrated with multitrack recording and overdubbing. But this is perhaps what makes jazz more irrational than most forms of popular music--popular music, especially rock, has accustomed itself to the routines of the studio.

In this chapter I have argued that the initial attempts at technical integration of popular music with the medium of sound recording followed a dual pattern of rationalization. Firstly, engineers and entrepreneurial producers interested in an aesthetic of the "sound" of the music they recorded gained increasing control over the recording process through separation recording: a set of techniques derived from experimentation with architecture, tools and techniques in the sound studio. Secondly, the aesthetics of the "sound," in combination with commercial demands in the form of cost efficiency, the need to highlight star performers (usually singers) etc., resulted in the adoption of overdubbing: a technique that allowed for the rational planning and control of the temporal aspects of music-making. The adoption of these two procedures led to a fragmentation--in space and time--of ensemble performance and the direct participation of the engineer and the producer in the creation of the recorded product. Thus, in the case of multitrack recording, mastery over the

musical materials clearly implies a corresponding mastery over the social relations of production.

But perhaps certain reservations should also be raised here. Edward R. Kealy (1979) has argued that during the late sixties many of the more successful "progressive" rock groups were able to gain greater control over their music, in part, because they were able to take part in the final mixdown procedure (this was not possible before extensive overdubbing had developed). In principle, I would agree with the general contours of this argument concerning the "art mode" of production with its attendant claims for the status of the sound mixer as an "artist" in his own right. Indeed, the struggle for control over the recording process is an important aspect of the real lived relations of production in the multitrack studio. But I would also argue that Kealy tends to exaggerate certain aspects of the various "modes" of collaboration. For example, he characterizes the entrepreneurial mode of production as "fluid and open collaboration" (Ibid.: 14); other writers have suggested that there exists an extreme variability in the degree that different producers exert their influence over the recording session (Chapple and Garofalo, 1977: 77-82; 178-179; Denisoff, 1975: 151-172; Frith 1981a: 89-129). Kealy may also exaggerate the extent to which the art mode prevails in the industry as a whole.<sup>1</sup>

But there is another level of this argument that is more relevant to the thesis at hand. For Kealy himself has pointed out the existence

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<sup>1</sup> Kealy's argument rests on an analysis of best selling albums in 1972. But hit records only account for about 5% of the total number of records produced; to generalize from this segment of the market, where the majority of the groups who could afford their own studios or work out self-production deals with their record companies might be expected to be found, would be misleading.

of a "recording consciousness" among rock musicians. This is reinforced by the fact that musicians must adapt to the technology if they are to survive in the industry: adaptation is added to the musician's personal goals as a "professional." It has been remarked by one studio engineer that even the low-tech home recording studio equipment now widely available is important to a musician's development, not so much as a creative artist, but in so far as it teaches the performer the basics of studio discipline, it makes him/her a more efficient participant in professional session work (Paul Northfield, chief engineer at Le Studio in a conference sponsored by CAPAC: Montréal, April 1986).

For Marcuse and the other members of the "Frankfurt School" the rationalization and routinization of work would already constitute a form of "domination." Leiss has stated that: "The internalization of mechanized work routines...[is one] of the principal means by which individuals surrender their critical faculties to the requirements of the production system" (1972: 204):

Nevertheless, the reservation expressed above concerning the ability of some musician's to gain control of the production process makes the idea of domination appear inappropriate. The concept of "power" (as amorphous as Weber considered it to be) might more accurately describe the studio dynamic. For while it is clear that "power" does circulate throughout the studio apparatus, it is a power that cannot, in Habermas' terms, be "clearly localized." It is a power that is the result of both an external and internal disciplining.

Rock is an interesting musical phenomenon: it has musical roots in earlier folk forms but these somehow seem much more remote than its roots in technology itself. Which is not to say that rock is entirely at ease

with those roots. Indeed, as Simon Frith has pointed out, rock is continually in a search for those other, more remote roots, and this causes it to reject technology from time to time:

Each of these moments in rock history fused moral and aesthetic judgements: rock 'n' roll, rhythm 'n' blues and punk were all, in their turn, experienced as more truthful than the pop forms they disrupted. And in each case authenticity was described as an explicit reaction to technology, as a return to the 'roots' of music-making. (Frith, 1986: 266)

Unlike jazz, which does not have to live this type of contradiction (as discussed in Chapter Two, jazz has a clear sense of its past and can renew itself through the use of that past), rock must continually construct myths around itself: myths of community, myths of authenticity, and myths about its own past. To the extent that technology plays a role in the construction of those myths, whether it be a positive one (integration with the musical practice) or a negative one (rejection by the musical practice), it too becomes a myth.

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## CONCLUSION

In his attempt to understand how Western civilization had come to be so fundamentally different from all other civilizations in the world, Weber conceived of a set of pure behavioral types, one of which--rational behavior--seemed to offer at least some kind of plausible explanation for the various patterns that he observed in Western religion, art, science, economy, politics, and, not the least of all, music. Two aspects of this rationalism--abstract calculation and methodical experimentation--were key elements in the development of modern science, itself based on a philosophical movement in the seventeenth century that advocated the mastery over nature as a means to greater knowledge and the satisfaction of man's basic material needs. This development, occurring as it did within the overall context of the rise of capitalism, contributed to the unleashing of productive forces and to the creation of a new social, political, and economic order. Within the context of capitalist economic relations however, the basic contradiction between scientific progress and technological innovation on the one hand, and social progress on the other, led to a situation where the domination of nature has also become associated with the domination of man.

It would be surprising if the powerful force of these developments were not, in some way, also felt within the world of Western music and, indeed, the effects of capitalism on the economic organization of music-making are well enough known. But the relationship between music,

technological rationalization and the philosophy of domination of nature is much less well appreciated. Following the lead of Weber and the general orientation of the "Frankfurt School," I have attempted to show how both Western art music and popular music, within the context of their own aesthetic, technical, social and economic developments, have embraced various aspects of technological rationalization and domination. In doing so, I have tried not to regard music as a simple "reflection" of social and economic structures (that is, I have tried to avoid making the leap that Adorno made in identifying the musical level of note and formal structure with the more general level of individual and social structure).

While rationalization and domination have been articulated differently in Western art music and in popular music, there have also been significant parallels. For example, notation, as a commodity form, as a means of organizing large ensemble musics, and as a factor in the definition and specialization of musical/social roles, was discussed in relation to various musical forms: classical, jazz, and Tin Pan Alley pop. But more recent parallels in the use of electronic technology appear even more striking. For despite their stylistic differences, and despite the vast differences in the level of their social and economic autonomy, both avant-garde and popular musics have developed preoccupations with a number of similar concepts and/or technical practices: the preoccupation with sound morphology and timbre in avant-garde music is paralleled by the idea of the "sound" in popular music; technical isolation of the "objet sonore" by technical isolation of instrumental sounds through separation recording; alteration of the morphology of sounds by signal processing; spatial distribution via multiple loudspeakers by detailed attention to



spatial panning; layering through the use of montage by overdubbing; devaluation of the role of the interpreter by the introduction of drum machines; the "liberation of sound" by the "liberation of performance"; the composer becomes performer by the performer becomes composer.

Throughout this study I have made frequent use of the idea of "expressivity" and juxtaposed it with technological rationalization in music. My intention has not been to valorize this particular aspect of music over any other nor to imply that music produced through rational calculation or electronic means cannot be "expressive." In part, my reliance on this term has been the result of adopting Weber's typology of action which specifies affectivity as distinct from rationality (although Weber himself admitted that actual behavior is often a mixture of more than one "type"). Weber's own characterization of melody as "expressive" and harmony as "rational" was not unlike the conventional eighteenth and nineteenth-century ideas concerning music—ideas with which I am not entirely in agreement (in my view, rhythm, tempo, dynamics and harmony all have their expressive dimensions singly and in combination). In the later chapters of the thesis, my use of the term "expressive" is intended to be more figurative, more symbolic than literal: that is, I make use of it in order to indicate that a social relationship has been constrained, altered, severed or interrupted. This is the sense in which the term "expressive" is intended when used in Chapter Four to describe various changes in ensemble dynamics—changes which are perhaps of less intrinsic musical value than the fact that the social relations of production have been interrupted; this fact is nevertheless manifest in audible form.

In the thesis, I have treated the appearance of musique concrète,

electronic music and multitrack recording within the broad context of historical developments in avant-garde and popular music. To have cut off the discussion of technology in music at these points is perhaps somewhat arbitrary, especially when considering the fact that these periods of technological innovation continue to have significance in musical practice. While it is impossible to go into detail here or to present any general conclusions with respect to more recent technologies, a few brief comments seem to be in order.

What is of most immediate interest is the manner in which the technical instruments, practices and aesthetics of the earlier period are taken up and embodied, as it were, within the design of the newer technologies. In avant-garde music, the initial development of the voltage-controlled synthesizer followed many of the technical design principles of the electronic music studio of the 1950s. Indeed the early synths were mostly modular in design and intended as miniaturized, integrated versions of the classical studio (Schrader, 1982: 127). Retaining the modular approach to design however rendered the early synthesizers virtually useless as live performance instruments. Thus, the aesthetic predilections of the 1950s became embodied as a design principle. The advantage of these systems over the classical studio was that they were not only smaller, but more efficient: through the principle of voltage control, the laborious process of constructing tones through tape editing and duplication was replaced by automated devices. Furthermore, the construction of basic sound material did not need to be elaborately calculated in advance but could be achieved through a more direct, empirical approach. In this sense then, the voltage-controlled synthesizer represented a dual rationality, a marriage between the basic principles of

tone construction derived from electronic music and an aural, empirical approach to sound derived from musique concrète.

The principle heir to the mathematically based musical logics has been computer music. As with voltage-controlled synthesizers, early sound synthesis programs for general purpose computers (e.g. those using the MUSIC V program or its various derivatives) attempted to simulate the functioning of the various devices found in the 1950s electronic music studio (Buxton, 1977: 64). Before synthesis could take place however, the composer had to specify all aspects of the sonic event and, in the case of MUSIC V, this would have to be done in a numerical form that could be understood by the program. Thus, to make use of these particular types of programs required, from the outset, that the composer develop a highly abstract, objectified conception of the musical event.

Of even greater interest however is the manner in which computer programs have been used to emulate compositional practice. Hiller and Isaacson's first experiments with computers during the 1950s were based on the assumption that musical compositions could be generated by computer if 1) compositional practice could be reduced to a set of codifiable rules; and 2) through the use of information theory, these rules could be translated into programmable procedures (Truax, 1976: 241). In this way, the creative process itself comes to be objectified as a purposive-rational set of "generate-and-test" procedures. What began with electronic music as an objectification of sound materials (i.e. nature) became an objectification of human thought processes.

As mini-computers have become available this particular self-regulating type of composing program has largely been superseded by so-called "computer aided composition" programs. In this type of program—often

called "interactive" programs--the computer plays only a limited decision-making role and is subject to intervention and control by the composer. Buxton refers to this process as a "dialogue between the composer and the program"(1977: 63). Of course, in Habermas' terms there is no real "dialogue" going on here at all. The computer program is not a "subject". It acts according to a set of predefined procedures and, at the command of the composer, responds by invoking another similar set of procedures. It is the fact that the computer responds at all that supports the illusion of a "dialogue"; indeed, in so far as the program has been defined by the composer, the program is only a projection of himself. As with overdubbing, the illusion of "interaction" or "dialogue" may be an example of Habermas' distinction between "homo faber" and "homo fabricatus": the composer not only objectifies himself in the products of his labor but also becomes integrated into the technical apparatus.

In the field of popular music, synthesizers have been in use since the late sixties. A significant aspect of these instruments is that they were designed specifically for live performance (some have made use of expressive devices not unlike those found in the earlier Ondes Martenot). However, this live performance philosophy stands in direct opposition to the frequent use of keyboard synthesizers in multitrack production. In the studio, they are often used as a way of rationalizing production costs by eliminating the need for extra session musicians. This practice is becoming especially prevalent today with the introduction of "samplers" (keyboard instruments that make use of digital recordings of any instrumental or natural sound). More than any other participant in the multitrack enterprise, session musicians are becoming an example of Habermas' notion of "latent domination": that is, to an increasing extent, the

system no longer needs to exploit them, it no longer needs to live off their labor. With respect to synthesizers, samplers, drum machines, etc., the multitrack studio must be regarded as an overall context in which a variety of technological innovations are redefined and put to specific use.

Pop music production is now also making use of personal computers which can be equipped with MIDI (Musical Instrument Digital Interface) and interfaced with inexpensive digital synthesizers. Many software designs have made use of multitrack recording practices as a model for the user interface (see Miller, 1985; DiPerna: 1987). In this instance, multitrack recording must be regarded as a metaphor for the compositional process (Loy, 1985: 16). In this way, the "recording consciousness" of pop musicians is perpetuated through the presentation of compositional activity as an explicitly defined set of routines and technical procedures.

In presenting these new technologies in this manner I do not wish to imply that they are simply the products of a kind of technological determinism. All of these technologies offer various and contradictory possibilities for their use. But the fact that some of these devices have been designed in such a way as to perpetuate earlier forms of technological rationalization indicates how the force of certain ideas can, in a sense, linger on in technological forms. Furthermore, the predominant uses of synthesizers in recording studios illustrates how the economic and social contexts of production continue to shape and redefine newer technologies. From the point of view adopted by Raymond Williams, such factors should not be regarded as totally determining; but rather, the two factors—design and context—must be acknowledged as constituting the real limits and constraints of the technologies. Any attempt to define

alternative, oppositional or other uses of these technologies must take these limits and constraints into account.

In applying the concepts of technological rationalization and domination to music, I have attempted not to suggest that there is a set of simplistic or literal correspondences between musical uses of technology and social/economic uses at large: the electronic manipulation and processing of recorded sounds is not strip mining, creating timbre with sine tones is not genetic engineering, and an isolation booth in a recording studio is not a solitary confinement cell in a prison house. My purpose has been to point out certain ideas and practices that have developed in music and to attempt to relate them to more fundamental attitudes present in Western society as a whole, attitudes that have, in part, shaped how we view our relationship to nature, to technology and to other human beings.

The fact that a scientific "idea" of nature had been posited as a model for musical materials seems somehow peculiarly Western: in most cultures musical sounds have been produced, more or less directly, by human beings. Few cultures outside the West appear to have come to regard musical sounds as something that exist so entirely apart from society, as something to be measured, analyzed, shaped and manipulated. And it is precisely this kind of separation that has been characteristic of Western man's relationship to nature at least since the seventeenth century.

One of the goals of modern scientific thought as formulated by Francis Bacon was the elimination of the old naturalistic categories: the myths and the superstitions that man had projected onto nature. Through science man would gain a more perfect knowledge of nature and its pro-

cesses, and through scientific and technological mastery of those processes man would gain material and (by implication) social rewards. Political theory of this period and shortly thereafter also occupied itself with the elimination of the naturalistic categories that had helped to maintain the social relations and the various hierarchies of power that characterized feudal society. Theorists argued that nature had not ordained social relations but that man himself had consciously entered into and could, consequently, alter those relations.

As Leiss points out in the final chapter of his book, The Domination of Nature, there are questions that have plagued Western society since the seventeenth century: Now that nature is no longer the model for human conduct, how will we decide how to act? What will be the structure of our relationship with nature and with man? These were questions of both great creative potential and also great responsibility. Leiss argues that the fundamental contradictions in Bacon's philosophy and the distortions that the rise of capitalism brought to political and social life have made our response to those questions equally contradictory and distorted. The various claims of liberation that have accompanied scientific and technological innovations have merely clouded an already complex set of issues.

It is perhaps a parallel set of questions that confronted music, both avant-garde and popular, during the periods of technological innovation described in this thesis: Now that composers had gained the power to manipulate external sound or to construct synthetic models of it, what aesthetic theory could possibly guide the use of this power? Now that the technical power to intervene in the spatial, temporal and social relations of musical production had been achieved, how would those rela-

tions be reconstituted in actual, and in recorded form? The manner in which those questions were initially posed and then answered in each of these musical contexts was perhaps indicative of the more general response to technological innovation of Western society as a whole. The various claims of liberation that have accompanied (and even guided the search for) technical innovation in sound production have also clouded the general perception of those innovations.

Max Weber was also aware of the problems that science had posed for Western society after the world had become "disenchanted":

Under these internal presuppositions, what is the meaning of science as a vocation, now after all these former illusions, the 'way to true being,' the 'way to true art,' the 'way to true nature,' the 'way to true God,' the 'way to true happiness,' have been dispelled? Tolstoi has given the simplest answer, with the words: 'Science is meaningless because it gives no answer to our question, the only question important for us: "What shall we do and how shall we live?"' That science does not give an answer to this is indisputable. The only question that remains is the sense in which science gives 'no' answer, and whether or not science might yet be of some use to the one who puts the question correctly. (Weber, 1958a: 143)

While both the ideas of Weber and those of the "Frankfurt School" have been used throughout the thesis, it is perhaps Weber's general approach to this type of study that I have attempted to follow. His concept of rationalization is perhaps the result of a particular mode of inquiry, a mode that combined both historical and comparative methods and continually sought out the unity and logic that lay, hidden as it were, behind the diversity of human affairs (in this respect, the concept is also a product of modern science).

In applying his concept to music, it seems to me that Weber was not so much looking for a very particular case with which to illustrate a



very general theory about social action; but rather, he was looking for what it was that made music so unique as a cultural form and how the study of music might reveal something essential about the structure of Western thought and action. Similarly, the initial aim of this thesis was to raise certain questions about music by focusing on issues concerning music, technology and society. In coming to a fuller understanding of musical issues it is equally hoped that some questions have been raised about technology and society.

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