

## MACHINES—A VISION OF THE FUTURE

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THE individualism of an age, now definitely passed, which neglected the universal for the personal, has given place to a more collective attitude. For years our literary and graphic arts were devoted to a hysterical glorification of the ego. Now a new art looms before us. In literature it will lean toward things social; in painting toward a clean and almost photographic realism. The individual, with his impulses, tastes and passions, must be suppressed, for unrestrained individualism has always been productive of bad and useless art. It jeopardizes fantasy, form and purity of workmanship.

Of all the arts none is so open to the peril of ego-centricity as music. Painting and literature, inherently descriptive, are bound to objectivity. Music, in spite of the futile experiments of the "programists," confines itself to the adventures of the spirit.

But this is not all. For its material presentation music requires the collaboration of a middleman, the interpreter. In the performance of a piece of music a process of individualization occurs, therefore, twice; first with the creator and second with the player. Two results are possible. The psychology of the interpreter may coincide with the creator's; then the conceptions will be congruent and the work escape uninjured. But usually the performer's conception differs substantially from the composer's and distortions take place which alter a work beyond recognition.

The most honest player, whose intention is to remain objective and true to the text, cannot avoid certain deviations in notes, tempi and dynamics. Our system of notation is childishly inadequate. Nor can any of us estimate a sonority exactly or maintain it with any degree of precision. Consequently most performances are bad, i.e., false. But the public, accustomed to this state of affairs,

applauds a performer who is subjective and "original" and speaks of a good interpretation when there is, in reality, a performance full of pseudo-original exaggerations. One might say here that the drama also needs interpreters. But the drama uses words, concrete situations which can be grasped and presented intellectually; there are bounds which the most capricious actor will not pass.



During the last hundred years orchestral and chamber music have become increasingly difficult to perform. Since Wagner's time the composer's technical demands on the interpreter have grown tremendously. The difficulties are not merely relative; styles and forms have actually become increasingly complicated. The logical outcome can be foreseen: in a few years we shall have music which only a few virtuosos will be able to play. Even today there are passages in contemporary scores which cannot be executed by the average good player.

The creative mind, long confined by the necessity of thinking instrumentally through fear of producing what is unplayable, has begun to break through these limits. The artist is no longer content merely to express what is instrumentally feasible. Discarding the thought of the interpreter, he has begun to write, timidly and haltingly, music of a super-instrumental conception.

This undoubtedly foreshadows new developments. The composer's imagination, subconsciously considering the player, has been limited to certain definite tempi and to certain gradations and formations of tones. This limitation removed, music will make use of new forms of expression, new combinations of tone. Speed and force, hitherto hampered by the comparative inflexibility and the limited strength of the human hand, will be augmented considerably.

For such music there are no players—only mechanical instruments. The machine has no limitations. Its strength and speed are practically limitless, its performance of unflinching precision and uniform objectivity. Not only can it replace the human

being, but it outdoes him, for it does not mutilate, it is impersonal.



One machine has been in practical use among musicians for many years. The inadequacy of tempo marks, *andante*, *allegro*, *presto*, incapable of indicating a speed with any degree of precision and interpreted in his own way by each performer, led to the construction of Maelzel's Metronome. The metronome is the beginning of what we may call the mechanization of music. It became possible to ascertain exactly the principal tempo of a piece. *Ritardandi* and *accelerandi* obviously cannot be recorded by the metronome. Recently an instrument has been invented which can measure the strength of sound, and with this it will be possible to designate accurately the dynamics of a piece of music.

Though orchestrions and mechanical organs have been many years in existence they were not built for the purposes of art and have remained in a state so primitive that they do not fairly demonstrate the mechanical-music contention. Let us look at the more perfect instruments which are being produced today.

They are of two distinct varieties: those like the orchestrion, the hand organ and the mechanical piano which, though they replace the player by mechanical energy, retain the acoustical material, that is, the instrument itself, and, on the other hand, those based on the principle of Edison's phonograph and the optophonetic film which work directly with sound waves and air vibrations. For the phonograph these vibrations are translated directly into curved lines and engraved upon the record; for the optophonetic film electric energy is transformed into light impressions.

Until the present time our procedure has usually been through an "interpretation" which we have mechanically fixed upon a record, a process which, automatically recording all the faults and failings of the interpreter, gains us little. With the orchestrion and hand organ, however, we have found the correct way; music stamped directly on the record is produced with ideal precision and without individual interpretation.

The paper rolls of the electric piano offer a precise and legible system of notation. The width of the roll corresponds to the length of the keyboard, each note has its definite space, its exact position is easily ascertained. I have found my own experiments in composing directly on the roll highly satisfactory.

The problem now is to find as adequate a system for instruments of the phonograph type. Here the tone is not transformed into graphic signs easily recognizable, but into short, wavy lines so minute as to be extremely difficult to study. This obstacle, however, might be overcome with a microscope; the lines could be divided into definite rubrics and a fixed scheme established embracing all shades of tone-color, pitch and dynamic intensity. With this new script definite sounds could be transcribed. Sound waves would be shown in highly magnified form; in order to be transferred to the record they would need to be reduced by a photo-mechanical process.

Experiments along these lines have, thus far, not proved fruitful. Precise shades of tone-coloring have been illusive, and a thousand other difficulties have appeared which may take years to overcome. Moreover, trials are expensive and, as available funds are small, progress will undoubtedly be slow.

But the advantages of such authentic records are immediately apparent. The composer can make use of any tone-color he chooses, even those non-existent in our modern orchestras. He can call for fantastic tempi and dynamics as well as the most complicated combinations of rhythm and not fear a poor performance. Everything will be mathematically exact. The composer becomes his own interpreter. Judging by recent developments in the phonograph industry, in five or ten years we may have instruments possessing perfect purity of tone and a complete range of dynamics. Music may, meanwhile, reach a crisis in development which will lead to the overthrow of all our inherited instruments and set us searching for new ones.



Style has always been dependent upon means at the disposal of the artist. We know that the purity of a work of art is indis-

solubly linked with the artist's objective and the proper use of material. A sculptor proceeds differently with wood and with clay. Composers distinguish between vocal, orchestral and chamber-music styles. The thought grows from the medium, and is, accordingly, lyric, harmonic or polyphonic. Orchestral style changed immensely with the introduction of clarinets and horns, and the jazz saxophone has contributed another entirely new idiom in recent years.

If the inclusion of a few new instruments has brought about such revolutionary changes what may we expect from a reform which deals with the basic principles of the instruments? The impossible leaps into the domain of reality. No more technical difficulties, no mistakes, no indispositions of the performers—a boundless field for the composer's liberated imagination. Without misgivings he may realize his subtlest dreams. The most daring imagination can scarcely encompass the range of new possibilities.

Our sense of intricate rhythmical combinations has been enormously enlarged during the last ten years, principally through Stravinsky and jazz. There are polyrhythms for which our primitive system of notation no longer suffices. I have conceived rhythmic ideas which I found myself unable to write down before working out a special scheme of numerical notation. And after these rhythms had been transcribed it was impossible to find players who, individually or together, could execute them precisely.

The mechanical instrument solves the problems of notation and interpretation. New rhythms will play an important role, new tempi, extremely slow as well as extremely fast, will become practicable. New tone-colorings which none of our present-day instruments can produce will be feasible—for example, imperceptible changes from the tone of the trumpet to that of the flute or from the clarinet to the cello. The range of instrumental coloring will be vastly extended; the flute will play in the bass, the tuba in the treble. There already exist a number of works for mechanical piano which employ a technic not based on the capacities of the human hand. They make use of *vibrato* passages in fast tempo, combinations of *vibrato*, *legato*, *staccato*



and *martellato*, of great chords, or simultaneous trills on an unlimited number of notes and even a new sort of trill which takes in the entire keyboard.



Most concerts do not meet expenses; in order to exist at all symphony orchestras must be heavily subsidized. I do not know the situation in America but Europe, suffering from the war, is in the throes of a desperate crisis. Orchestras have been numerically reduced and the musicians, paid much less than formerly, have been obliged to earn money on the side. As a result they are overworked while the quality of their performance suffers.

The situation is so acute that it leads one to speculate whether in fifty years there will be permanent orchestras. My conclusion is that in fifty years we shall make music mechanically. The mechanical orchestra, whatever form it may take, will be inexpensive. The initial outlay might at the most be equivalent to the cost of maintaining one of our present day orchestras for five years. One man at a switchboard should be able to operate the entire apparatus. There will still be famous soloists who will bring their accompanists with them—a phonograph record or a pianola roll. The cost of buying musical material will be no greater than it is today. There might be a supplementary charge on the records, of several hundred per cent, which should go directly to the composer and would of course bring him royalties considerably higher than those he now enjoys; this might even be applied to songs and piano pieces which today go free.

When my first article on this subject appeared in the Viennese periodical, *Pult und Taktstock*, in 1924, it stirred up a literary war in Germany and Austria which lasted half a year, one well-known critic declaring that I was trying to lead music to perdition. But a year later history justified my prophecies for London heard a concert of compositions written expressly for the Phonola. In the summer of 1926, George Antheil presented his *Ballet Mécanique* to Paris, and shortly afterward a concert of

music for mechanical instruments took place at the festival in Donaueschingen. Similar projects are under way in Vienna and Berlin. Last fall, *Musikblätter des Anbruch*, the leading German magazine devoted to modern music, issued a special number concerned with the many problems of mechanical music. In ten years these facts will all be accepted as initial steps in a natural, historical development.

Though most of our well-known composers are inclined to look askance at mechanical music, there are several who have been considering the subject for years. Busoni in his *Sketch of a New Aesthetic in Music*, published in 1904, mentions a mechanical instrument called the "Dynamaphone," invented by Dr. Thaddeus Cahill, an American. In 1912 Schoenberg was considering the project of a mechanical orchestra for the performance of one of his works. In 1920 Igor Stravinsky arranged *Les Noces* and *Sacre du Printemps* for the mechanical Pleyela-Piano. The first large piece of music definitely conceived for mechanical interpretation is the *Ballet Mécanique* of Antheil, finished in 1925. This is not the place for an extended appraisal of that daring and extraordinary work. In it Antheil has established all the basic principles of mechanical music. Many other young composers—Hindemith and Toch for example—are experimenting with this idea. The next few years will bring us interesting developments.