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COMPOSER AND ELECTRONIC MUSIC CONSULTANT; ORIGINATOR OF THE NUMAUDO AND NUMALITTERA SYSTEMS; INVOLVED WITH INTERFACING ART AND SCIENCE.

KEEPING IN TOUCH

PLEASE DO NOT HANDLE

HANDS OFF !

PATRONS ARE REQUESTED NOT TO TOUCH ANY OF THE OBJECTS ON EXHIBITION IN THIS MUSEUM.

Such signs in the art galleries of the world must be centuries-old traditions.

It becomes frustrating not to be allowed to run one's hands over a sculpture, and this is especially so in the case of some modern sculptures in new materials (for instance, when metal, cold to the touch, is used together with plastics and/or wood, warm to the touch) and where rough and smooth textures are exploited.

In 1921, the famous Futurist, Filippo Tommaso Marinetti, gave a lecture in Paris in which he announced a Futurist art to be called *Tactilism*.

To prove his theory, Marinetti presented several concrete examples of Tactilism, called *Tactile Tables*. These tables had pieces of cloth arranged in such a way that one received definite impressions and sensations by running one's hand over them.

In the heyday of science fiction, and maybe now, for that matter, writers used to predict the coming of the "feelies"—of some kind of 'teletactor' equipment synchronized with movies or TV.

(Continued on Page 9)

Change-Ringing

Impatient and nervous people often jingle coins in their pockets, but that is not what we mean here by ChangeRinging.

The credit-card and the proposals for a "checkless society" threaten to make this irritating noise obsolete; besides which the new nickel-alloy-clad dimes and quarters with copper centers won't ring like the old ones used to.

No, the practice of 'ringing the changes' to be discussed here is at once an application of mathematics, a sport, a peculiarly-disciplined athletic exercise, a merry noise to promote community spirit, a custom, and the basis of a kind of comradeship in pursuing a unique avocation. These factors, all put together, create a tradition and a ritual over and above the existing traditions and rituals of the churches in whose towers the bells are rung.

While church-bells are undeniably musical instruments, opinion is divided as to whether the ringing of changes on a group of such bells is really music, whether *melody* or *tune* can legitimately be used of the effect that results when bells are rung in this special manner.

Change-ringing is a particularly *English* practice, as opposed to the playing of frankly musical compositions on sets of bells (carillons) in such countries as Belgium and the Netherlands.

So far as the mathematics involved is concerned, changes could be 'rung' on almost anything—the keys of a piano, the notes of a tin whistle, or for that matter the pots and pans in your kitchen!

Indeed we will link up the theory of change-ringing with modern music of the kind that some people do not like because it is not 'tuneful' to their ears. Moreover, the mathematical principle of

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(CHANGE-RINGING, CONTINUED)

permutations which forms the basis of change-ringing also turns up in the most unexpected places in modern life, both in scientific or technical fields and in the activities of ordinary life, such as card-playing or the making and using of various decorative patterns.

New applications of the permutation theory to the use of computers are being made every day, so we will hear more of permutations and combinations as time goes on.

Traditional change-ringing thus represents a unique *synthesis*: full-sized and therefore heavy bells, usually hung in a church tower, entailing athletic exercise by the ringers, and also generating a set of rules and customs surprisingly like those of games and sports, this neatly tied together by the permutation principle and given community acceptance because of its association with churches that have peals of bells.

When your editor was about 8 years old, he lived near a church where change-ringing was practiced several times a week, so there are at least a few places in some U.S. cities where the custom has been imported from England.

Since American preference usually is for the carillon, on which real tunes are played, it is expedient here to contrast the carillon with change-ringing. Sometimes both uses are made of a given set of bells.

First, the method of ringing: A single church bell, or a small group of them, is mounted in such a way that each bell can swing almost through a complete circle, say 300°, from inverted mouth-up position through normal resting erect position to inverted position again. Locking or holding means are provided to hold the bell at one end of travel, and the ringer sets the bell in that inverted position by a special skill in manipulating the rope, which passes around a wheel, which in its turn rotates the frame holding the bell.

Since, as everyone knows, the clapper is free to swing in any direction, in this method of ringing *it will not keep striking the bell in the same place*--and this is very important, since a bell struck continually at one point will usually crack; remember the Liberty Bell and many other famous bells all the way from here to Russia. Even with good care, bells often crack and have to be recast. Bell history is full of instances where bells were damaged in transit.

In some instances, bells were cast in the yard of the church where they were to be used, to avoid the transportation risks.

Despite the poetic allusions to silver bells and golden tones, gold and silver are *not* good things to make bells out of. Gold and silver plating have had to wait for electronic musical instruments to be useful, where they serve to make switch contacts more reliable. Bells are made chiefly of copper and tin, and the epithet 'tinny' is a shameful slander on a metal that contributes to fine tone, not only in bells, but also in organ-pipes. Zinc goes into brass, used to make small bells and handbells. We will have to take up this subject some later time, lacking space here in this issue.

We said that change-ringing is done with freely-swinging bells, and this is in sharp contrast to the carillon that plays real tunes: since the carillon is usually played from a sort of giant keyboard, the hammers that strike the bells are connected to it through a maze of wires and levers, and in this case the bells are mounted stationary, and they are struck from outside. To avoid cracking, the bells have to be turned every so often to present a different area to the hammer.

The tone of a single bell is very complex, and is quite unlike that of a stretched string. Also, it changes radically while it is sounding, and the sustained portion is very different from the 'strike-note'. This peculiar tone is part and parcel of the change-ringing syndrome, and helps explain why change-ringing of *real* bells is less boring than ringing the changes on anything else. Next best are handbells, which are used for practice.

The method of ringing is necessarily slower than a carillon can be played, or than any ordinary musical instrument can be played, or for that matter, than the just-mentioned handbells can be played.

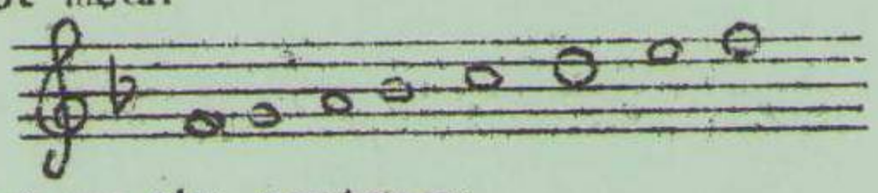
This imposes a time-interval, making it difficult to sound the same note quickly twice in succession. In turn, this causes a change-ringing rule: a bell can't jump suddenly from say first to fourth place, but must proceed one step at a time. No given change may be repeated, except that the first change is also the last--'rounds' being the name for the normal obvious order, such as 1 2 3 4 5.

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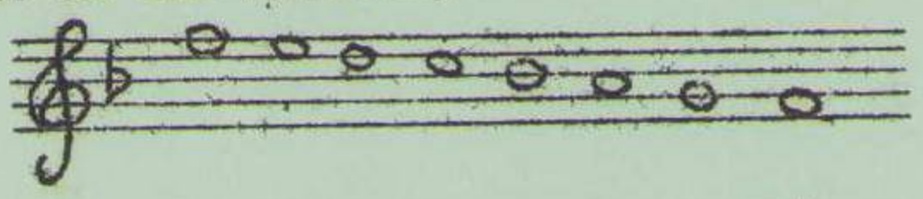
CHANGE RINGING continue' ***

These and other rules and customs are of course incompatible with certain ordinary rules of music, such as the extensive use of repeated notes in melodies, and the almost inviolable rule in ordinary composition that there must be one or more *main themes* or *motives*, repeated again and again and returned to, and developed in various ways. Obvious example: Beethoven's *Fifth Symphony*.

Almost as if to contradict ordinary musical principles, and to make change-ringing harder for musicians to understand, the numbering of the bells is *downward, in pitch, not upward.* **1 2 3 4 5 6 7 8** does not mean



but on the contrary



thus antagonizing musicians of 'most any country. Do you suppose this has anything to do with the British custom of driving down the left, rather than the right, side of the road? Anyway, since this normal numerical order of the bells is a *descending* scale, the appropriateness of descending scale-passages in Christmas music such as *Joy to the World* will now be obvious. It will be equally obvious where the cliché's written for movie-studio orchestras to play for films involving churches and/or bell-ringing, come from!

Bells for change-ringing are generally tuned to a portion of the major scale, but minor sometimes is used. Notes may be left out of the scale, and there is no theoretical objection to some other scales being used, although this has not been done so far as we know.

Now for the mathematical basis: permutations, or changes of order, are related to the *factorial numbers*. That is, if you want to know in how many different ways n things can be arranged, multiply together the integers $1,2,3,\ldots n$.

The result of this multiplication is known as 'factorial n' or sometimes 'n factorial'. The symbol used to be $\lfloor n$, but printers hated to set that up in type, so $n!$ is the usual modern version.

Like for instance: In how many ways, how many different orders, can three things be arranged? $3! = 1\times2\times3 = 6$.

abc	acb	bac	bca	cab	cba
123	132	213	231	312	321

Smith, Brown, and Jones. Smith, Jones, and Brown. Brown, Smith, and Jones. Brown, Jones, and Smith. Jones, Smith, and Brown. Jones, Brown, and Smith.

In how many ways can five things be arranged? $5! = 1\times2\times3\times4\times5 = 120$. Some piano teachers have students 'ring the changes' on the five fingers, going through the 120 possible different orders of five notes. Beyond $\lfloor 5$, the factorials quickly escalate to fantastically large numbers.

The ploughman homeward plods his weary way. Homeward the ploughman plods his weary way. The ploughman plods his weary homeward way. The ploughman plods his weary way homeward. And so on for quite a distance. In Spanish or Russian or Esperanto, more permutations would be permitted by their rules of grammar.

Seven chorus-girls could stand in a single line near the footlights in 5040 different ways.

The 52 cards in a standard deck can be shuffled into 52! different orders, but don't expect us to calculate that enormous number or write it out here! You will now realize why the exclamation-mark is an appropriate notation for factorials after all!

$1\times2\times3\times4\times5/6\times\ldots\times50\times51\times52$; now let me see, that's * * * well, of course, if you have no other use for your time, ...

Well, if 52! doesn't flabbergast you enough, how about (7!)!, *i.e.*, 5040! ? That is, if there are 5040 ways to ring 7 bells, then there must be *factorial 5040* ways in which these changes could be taken in succession.

It thus becomes evident why the rules as to which changes may follow and precede which other changes, are so very strict. Even with these restrictions, a large number of change-ringing compositions are possible.

Since there are as many men ringing as there are bells, the memorizing of the sequence of the changes is far more difficult than it would be for a single performer to memorize a series of changes and to play them through on a piano or xylophone or flute or trumpet. Sometimes there is a conductor in the ringing-room who *calls* the changes, much as the caller at a square-dance meeting directs the dancers. Accordingly, certain maneuvers of the sequences of the bells have technical names: *hunting, bob, dodging, slow work, quick work, ringing behind.*

CHANGE-RINGING *continued*

Since it is unlikely that many of you will take up change-ringing at some church and since the present writer doesn't plan on such a career either, these technical terms needn't detain us for long. Those who are more interested may read Wilson's *Change-Ringing* or consult the article on Change-Ringing in *Grove's Dictionary of Music*.

We can't go on further without calling your attention to Dorothy Sayers' mystery novel *The Nine Tailors*, where the story is intimately woven with the facts and environment and atmosphere and customs of change-ringing.

Number of Bells Involved	*Name of this Number*	*Possible Changes (Factorial Number)*	*Nominal Time Required To Ring All Changes*
4	Singles	24	1 minute
5	Doubles	120	5 minutes
6	Minor	720	30 minutes
7	Triples	5 040	3 hours 30 minutes
8	Major	40 320	1 day 4 hours
9	Caters	362 880	10 days 12 hours
10	Royal	3 628 800	105 days
11	Cinques	39 916 800	3 years 60 days
12	Maximus	479 001 600	37 years 355 days

The above table was swiped from *Grove's Dictionary of Music* and was probably compiled a century ago. Frankly, the estimated times for ringing all the possible changes, one of each permutation, seem unrealistically short for real bells equipped with rope and wheel--and no time for eating, sleeping, coffee-breaks, etc. Would the 96 strokes of the 4 bells be over inside one minute? The 5,040 changes on 7 bells involve 35,280 strokes which might not get all done and over with inside of 3½ hours.

However, if one ran through the permutations on a piano or flute the changes would be over in far less time than indicated in the table, and of course a computer with sound-generator hooked up to it could give out the changes as a dizzy blur-whirr.

That is, a contemporary composer who wanted to use permutations in his music would not be slowed down to the natural pace of real bells, and more importantly, would not have to follow all the change-ringers' rules, such as that forbidding sudden jumps like 52341 to 43125.

These rules, you have to remember, apply to a group of people, say eight men each holding the rope to one of a group of eight bells in a steeple high above them, and not enjoying too good a view of each other's rope-pulling, not being able to see much if any of the bell up there on the other end of the rope, and on top of that, a certain element of time-lag being involved. Also, there is a continual confused jangle of after-sounds from all eight bells, containing at least one undertone (the hum-note) as well as several overtones, which overtones are not spaced anything like those of a string or wind instrument, but instead are grouped into a pungent clang that any jazz pianist would envy. *Eight* such after-sounds are going on at once, and if the strike-notes of the bells are in tune to a recognizable scale, that does not guarantee that all the after-sounds are in tune with themselves, let alone with those of the seven other bells!

If you were in the church's ringing-room pulling on one of those ropes, you would not want your place in a given change to jump erratically from the preceding change or to the next change. You would want the rules and restrictions, so that you could memorize the ringing methods and so that you wouldn't be embarrassed by losing your place.

If you make a mistake, the *whole town* knows about it! Not knowing which ringer is pulling the rope to which bell, they blame the whole group for the lapse. Thus certain methods of ringing become traditional, and little room is left for really new change-ringing compositions, although there is still scope for variations, and for many selections from a series too long to be practical, as for instance 5040 out of 3,628,800.

(*continued on next page*)

CHANGE-RINGING, continued

Such shorter selections from a long series of possible permutations may be made by joining otherwise distant steps according to the rules of the particular method. This can be done, usually, at a number of points, and working out such selections becomes a sort of homework or mathematical puzzle. Since the methods of ringing determine in advance a whole series of changes, it is not necessary to write out five thousand-and-some individual changes before the ringing can be done.

A long series of changes, according to some authorities, 5,000 or more, is called a peal. But *peal* is also the name for a group of bells used for change-ringing. A short series of changes, such as 200 or so, is called a *touch*.

Note that *major* means 8 bells undergoing changes, and has nothing to do with the musician's *major mode:* whether the peal of bells is tuned to a major, minor, or some freaky way-out scale would make no difference. Similarly, *minor* involves six working bells, even if they are tuned to a major scale and whether there are more bells in that steeple or not.

The *treble* is the highest-pitched bell of the group being rungat the time, and the *tenor* is the lowest. But remember that the pitches are numbered downward, not upward, so that the treble is No 1 and the tenor will be 4 or 7 or 9 or whatever number is in use. Also, in many methods the tenor is *rung behind;* she does not enter into the changes the other bells make in those methods, but always comes last in each change, thus punctuating the change like a bar-line in regular music.

Raven's *The Bells of England* gives the following example of a 'plain hunt' on 4 bells:

1234	4321
2134	4312
2314	4132
2341	1432
3241	1423
3214	4123
3124	4213
1324	4231
1342	2431
3142	2413
3412	2143
3421	1243

(1234)

Now get out your red pencil and rule a thin line through all the *diagonal* rows of numerals 1 in the list of changes just given. The diagonal lines of 1's thus revealed will tell you what 'hunt' means much better than any page of smoggy verbiage we could cook up.

Now visualize a large English church, and inside it, the ringing-room with ropes and a fairly athletic and patient man at each, and assume you are one of these fellows and it's your turn to pull your rope and you do so and the bell sounds somewhere up there, and the after-jangle is also going on. It's a day or two after Christmas, 1829 or such a matter, and they haven't invented television yet, and the street-traffic outside does not reverberate with the sound or the stench of automobile exhaust or motorcycle roar, and *bell* does not mean to the average person either telephone bell or streetcar bell---and certainly not electric doorbell! This is the context in which to think about *hunting up* and *hunting down,* and is also the context and atmosphere in which to bring to life the tables of numbers given here.

That is, do not think of these numbers as being originated in our age of automation and coming out on a cash-register tape or an adding-machine tape or a computer printout or a deck of I B M punchcards.

Today's methods of using permutations and combinations, even the musical ways, are quite different, and we will allude to this before closing.

We are so used to visualizing history as wars and rumors of wars, turmoil, treachery, disorder, cruelty, injustice, revolutions, intrigue, surprise attacks, etc., that it should be a real relief to you to realize that there are some islands of tranquillity, tidiness, order, proper functioning of rules, and *consistency* in the world, after all, and one of these is the practice of change-ringing of bells, which seems to have started in 17th-century England and was promoted by such experts as Fabian Stedman, a printer who printed up sheets with the arrays of numbers and published a book called *Tintinnalogia,* and after whom the Stedman's method is named.

Note that this is only a small part of the long history of bells themselves, both small and large, so that we will have to return to bells in a later issue and tell how ancient gongs and metal bars evolved into crude riveted-together cowbells and such, and later into the graceful outline now thought of as 'bell-shaped', and then after change-ringing, the more refined

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(CHANGE-RINGING, continued

systems of tuning bells to themselves and to one another, developed for the carillon on which actual tunes are played; and because carillon-playing involves sounding several bells simultaneously or almost so in chords, tuning must be more careful than that required for change-ringing. In change-ringing, it would be a mistake if two or more bells were struck simultaneously.

This has created a curious paradox in more recent years: English foundries cast and tune fine bells for carillons, but nearly all of the finished carillons are shipped away to Europe or the United States, the English churches preferring to continue with the changes of Kent Treble Bob Major, Stedman's, Surprise Major, and Grandsire Triples.

Actually, there is no reason why the same set of bells cannot be both part of a carillon and also be used for change-ringing. Of course, this might involve some mechanical complications, but it is far from impossible. Also, there is an important and very useful intermediate case: the Canterbury and Westminster clock-chime tunes, copied on tower-clocks and mantel-clocks and grandfather-clocks virtually around the world.

Now to wind things up, let's turn to musical applications of the mathematical principle of permutations and combinations outside change-ringing. Take the familiar Westminster Chime tune, for a starter: there is an approximation to the ringing of changes, but there is the freedom of *repeating* a note. Immediately it becomes more interesting and less monotonous.

Then we may progress to bugle calls, where there are only four notes, but this time *rhythm* is introduced. Four small bells could sound bugle calls, and so could auto horns.

Quite a number of finger exercises for piano, violin, and other instruments involve permutations and combinations. The musical form called *Theme and Variations* may apply permutation in some instances. Once rhythm is admitted (the change-ringing bell-strokes are supposed be of equal duration) *rests*, i.e. silences, may enter into permutation with notes.

If permutation, preferably in a more sophisticated form than ringing the changes, were substituted for the monotonous *exact* repetitions, such as the Alberti bass and the rigid ostinati, everyone would gain. The uninspired oom-pah-pah of the traditional waltz was one of the tortures of our boyhood piano practice, and we found out that other budding pianists agreed with us. How simple it would have been if composers permuted or varied the bass-accompaniment-pattern! Who could possibly lose by this creative introduction of a little variety?

Similar remarks apply to marches, as well as the various dance-forms. Popular music has frequently committed the greatest excesses in the accompaniment department, the most stultifying boring incessant monotony, reminding this listener of nothing so much as a Linotype machine, a printing-press, a windshield-wiper, a stamping-mill, or a pump.

The monotonous rhythms and accompaniment formulas of much popular music reduce the performers to mere machines: a machine could do that stuff much better! They mock their own humanity; they degrade themselves.

We won't describe What Ought to Be Done About It here because the trouble is precisely that there has been too much *prescription* and not enough freedom. If everybody applies the same remedies to escape the musical straitjacket, the situation will be just as bad as before. Individuality implies difference.

Which brings us to another application of the permutation principle: the tone-row of *twelve-tone serialism*. Change-ringing with its harnessing of factorials and suggestion that the changes themselves can be permuted, curiously anticipates Schönberg's atonality and its consequences by just over 200 years.

Arnold Schönberg, realizing that the ordinary musical key-system reigning supreme in the 19th-century Romantic Period would come to thwart progress in certain directions, constructed a new compositional system in which the ideas of tonic, dominant, subdominant, major, minor, modulation, resolution of discords etc. were discarded, and, to prevent anarchy, a new kind of order was imposed, with its new set of rules and principles.

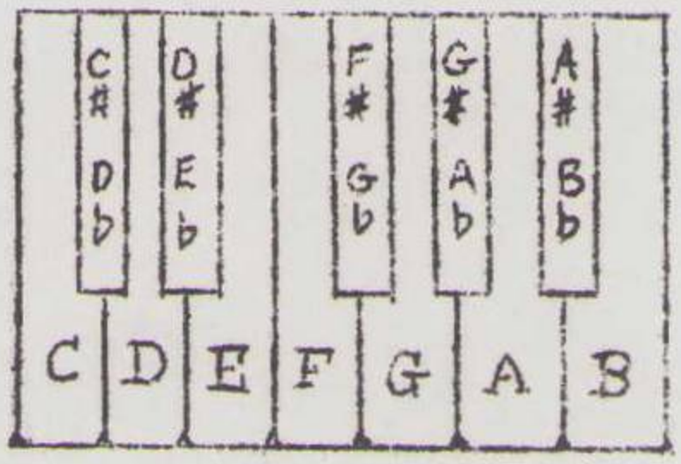
His followers unfortunately often lack his genius, so that contemporary serialism, the modern consequence of Schönberg's twelve-tone system, often sounds boring, and worse yet, the followers' compositions are far too much alike, although Schönberg did not fall into his own trap like that.

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CHANGE-RINGING AND SERIALISM, continued

In that table back there on page 4, you will see that the last line indicates that 12 bells can have 479,001,600 different changes rung on them, and that it would take almost 38 years to do so.

If instead of twelve church-bells tuned probably to an octave-and-a-half of the major scale you substitute the twelve keys of a piano lying within one octave, say:



you could ring the 479,001,600 changes on these twelve keys in only 19 years or so, since the average pianist can play much faster than bell-ringers can. The twelve-tone-row of serialism (atonality, dodecaphony) is governed by the same rule as change-ringing, namely, that all twelve tones must appear in a given change, and each one only once.

Your friendly local pessimist will be quick to point out that 11! or only 39,-916,800 rows are really possible, since the four hundred seventy-nine million should be divided by twelve to show that every 12 of the 479,001,600 are merely transpositions to a different pitch. That is, octaves are neglected as being identities, as a sort of duplication.

It seems on the surface that even 'only' 39,916,800 rows, themes, or basic tunes ought to last all modern composers for quite a while to come. Alas! they only *look* different on paper. Once the traditional organizing factors, such as consonance vs. dissonance, modulation to other keys and modes, tonal centers, rules of harmony, and the system of relations built up by composers' usage over several centuries, are all discarded, the composer is forced *carefully and deliberately to avoid* implying these old relations: it is as though he were being compelled to ransack Beethoven's, Schubert's, Wagner's, and Brahms's wastebaskets for the thrown-away themes they couldn't fit into their system.

And that is how serialism sounds to many people. Few of the most dedicated serialists can hum, sing, or whistle their tunes and naturally this raises the question, Why not? Let's try to answer: Just as the additional restrictions imposed on change-ringing of bells (not all of which have been discussed here, owing to lack of space) are determined by the nature of bells themselves, their weight, ranging from several hundred pounds to several tons, the ropes and wheels and clappers, and their special tone-quality, and the assignment of one man to one bell, the application of permutation to the twelve-tone row is modified and determined by the availability everywhere of pianos at the time serialism originated, the urgent necessity of avoiding certain implications of the old tonality-system, and the fact that certain patterns are suggested by the layout of the keyboard shown opposite, and by the conventional staff-notation used to represent the sounds.

Also, the half-of-an-octave or tritone, the third-of-an-octave or 12-tone-tempered imitation of a major third, the quarter-of-an-octave or 12-tone imitation of a minor third, and the sixth-of-an-octave or 12-tone compromise between two kinds of major seconds, assume a new and commanding importance once the old key-system is discarded or even weakened. That is, 12 is divisible into halves, thirds, quarters, sixths, and twelfths. The 12-tone equally tempered scale of the piano exhibits too much symmetry. The old major-scale system imposes an *asymmetrical* 7 + 5 pattern on the 12 tones, shown on the keyboard above, reflected in the staff-notation, and also implicit and explicit in the staff-notation and the letter-names C D E F G A B and also the French, Italian, and Spanish names *do ré mi fa sol la si*.

Give up tonality and you must also forsake the asymmetrical pattern, which means that you really need a new keyboard with the 3 x 4 or 2 x 6 arrangement of a dozen eggs in a box, and the expression of absolute equality of status of the twelve tones as already provided *inside* the piano with the monotonously uniform row of hammers and groups of strings, or the uniform configuration of wires in an electronic organ, or reeds in a reed-organ, or frets on a banjo, guitar, ukulele, or mandolin.

Give up tonality and the symmetrical division of 12 into 6,4,3,and 2 is revealed, dis-covered, un-covered, and asserts itself. Play and/or listen to the piano pieces of Debussy and this should be evident. He pushed the whole-tone scale and the augmented triad to their limits and thus he began *and* ended them.

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CHANGE-RINGING, concluded.

The attempt to exploit the whole-tone scale and augmented triad beyond where he left off gives rise to the most trivial, banal, annoying, and futile of soap-opera cliché's, and as for the diminished-seventh chord, dividing the 12-tone octave into equal quarters, that had already been exploited to the point of Ugh!

This is said *in respect* of Debussy and Schönberg and Bach and some other composers, not to detract from their achievements but to point out that the attempt to copy them slavishly and to repeat them is an act of disrespect and an admission of lack of creative inspiration and originality.

The names C-sharp and D-flat applied to the second of the 12 equal notes of the atonal system, or their French equivalents *Do dièse and Ré bémol,* are thus misleading when used to discuss the works of the successors of Schönberg, because they imply Notes Numbers 2, 4, 7, 9, and 11 in some way inferior to or subordinate to, or derived from, Notes 1, 3, 5, 6, 8, 10, and 12 of the atonal dodecaphonic scale. We should use the last twelve letters of the alphabet *opqrstuvwxyz* or the first twelve Greek letters αβγδεζηθικλμ or the duodecimal numerals *0123456789XE,* or one or another of the sets of twelve syllables that have been invented for this purpose.

Twelfth-inch cross-section graph-paper is available for notation of such music.

Player-piano rolls also offer an impartial notation which furthermore causes the performance of the music.

Why *twelve*-tone serialism rather than 13 or some other number? The crassest and crudest of economics and expediency and taking-for granted, we believe. Pianos were handy; pianists and piano-tuners were available as highly-trained standardized products; it would have cost too much to go to 11 or 13 tones per octave and really get away from the old tonal key-system.

This composer does not follow the serialist teaching in his own compositions, but that is not a repudiation of permutation principles as a possible musical resource. Rather it is the consequence of being mainly busy with the exploration of an expanded tonal system applied to such systems as the 17, 19, 22, 24 31, 34, 41, and other equal and unequal divisions of the octave now economically feasible because of electronics and automation.

Here's an idea for you: Why don't you compose on a greatly-liberalized change-ringing permutation basis, using percussion instruments of indefinite pitch or frank noisemakers, instead of bells? By adding rhythmic variety as the bugle-calls do, interest can be sustained.

It is not too likely that the change-ringing custom will spread around the world much more than the already-obtaining sporadic instances of emigrating Englishmen bringing it with them to overseas churches, but in its homeland it is a sufficiently firmly-established tradition that there can be no danger of it dying out. It is sufficiently athletic and tiring, especially in the long peals of over 5000 changes, that maybe it will eventually be accepted for the Olympics!

Our only listening to it was in about 1926 and again in 1931, when we lived a block from the Trinity Church in Portland, Oregon, where change-ringing went on about two or three times a week.

This brings up a question: Why does the city of Los Angeles have such a prejudice against church bells? Is there a law against ringing them, or a tacit agreement not to ring them very loudly? In almost every other city we have visited, far more bells were heard.

It can't be claimed that modern autohorns and pneumatic riveters and motorcycles and backfiring and freight trains and other city noises, all of which are tolerated,--and now jet aircraft!--are more pleasant than bells, so it probably has nothing to do with anti-noise laws.

This being the December issue, we thought that this article would be appropriate: the change-ringing tradition surely explains the numerous bells on Christmas-cards and holiday decorations, and the proverbial expressions *Ring the changes on something or other* and *"Ring out the old year, ring in the New"* will surely have more meaning for you now.

The basic mathematical idea had its appropriate expression in 17th-century England, and then, as we saw, gave rise to atonal serialism as the 19th century gave way to the 20th. The latest thing is 'aleatory' or 'chance' music, which has more to do with random numbers than permutations and combinations, but is not too remote from the latter.

Now let us speculate: What would Edgar Allan Poe's famous poem, *The Bells,* have been like, if he had heard streetcar bells, cash-register bells, typewriter bells, electric doorbells, and--oops! the telephone bell is ringing!

KEEPING IN TOUCH

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Usually these science-fiction writers tied in the "feelies" with smellevision in whatever way they saw fit.

Admittedly, touch is a primitive sense, but it surprising how much it can be developed and refined by training. In his lecture, Marinetti had such training in mind.

Actually, we are dealing here with something more complicated and sophisticated than feeling proper: heat, cold, and kinaesthetic sensations combine with the feeling sensation in such a complex manner that no wonder one is inclined to call all these different senses by the one name touch.

Also, there is a pain sense, with its own nerve-endings, and this kind of pain is different from the other kind caused by overstimulation of the feeling sense, excessive heat or cold, muscular over-strain (i.e. overstimulating the kinaesthetic sense) and overstimulating sight, hearing, or taste. The fear of pain may have something to do with the reluctance of some people to explore tactile art, although to our knowledge, no tactile artist has put any broken glass or razor blades or knife-edges into his works!

Another reason that tactilism may have been slow in entering the museums, art schools, and public exhibitions has to do with the mid-nineteenth-century prudery, which in its more extreme forms condemned the sense of touch as evil and dangerous--too liable to arouse those horrid forbidden sexual passions!

This probably reinforced and was reinforced by the elaborate etiquettical ceremoniousness of wearing gloves--and surely we do not have to spend too much time lamenting the slow retreat of the formal glove, when practical forms, such as the mitten to keep out cold, continue on their merry way. Perhaps we could turn the further investigation of this glove question over to Marshall McLuhan, who has been busy reassuring us that "we are moving from a print-dominated, visual environment into a new audile-tactile environment, where the sense of touch will take the place it enjoyed before the days of Gutenberg".

An amusing psycho-sociological sidelight on this artificially-acquired aversion to touch was exhibited by a certain Hollywood radio-and-TV personality who kept harping on how he sat at one end of a long table when interviewing people so that they wouldn't get a chance to touch him---and then every few sentences he would interrupt himself to ask "How does that grab you?".

One of the promoters of a self-improvement course here in Los Angeles has been sending out "scare" circulars for the past several years loudly proclaiming the alleged dangers and hazards and debilitating effect of shaking hands with other people--which seems all the more strange an attitude to take, when his father was partial to the systems of manipulative therapy which involve all kinds of massage and grabbing and kneading muscles and whatnot.

Sorry we got onto the "therapy" kick, but might as well exploit this opportunity to bring up the subject of the Utilitarians who are opposed to Art For Art's Sake. Like their cousins the narrow-minded orthodox religionists whose motto seems to be, "If it's fun, it must be sinful", the Utilitarians allege that if anything is not Useful as they define "Useful", it is immoral and harmful. The Utilitarians try to drive artists into a corner, not letting them go unless they agree (under duress) to label their art-work 'Therapy'. If they had their way, the new tactile art would become the exclusive domain of schools for the blind, and as such it wouldn't even be called art but by some aseptic, cheerless term.

So don't expect us to go around trying to justify the existence of and the trend towards tactile art by claiming it is Useful for some lofty end. The present writer is too busy thinking up ideas for new Tactiles and proceeding to make them.

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During the Xmas holiday rush a year or so ago, there was even a tactile game for children, called "Feely Meely", where the players tried to identify different objects in a closed opaque box by feeling them. This could mean a more receptive attitude toward the sense of touch these days; it could even be a confirmation of McLuhan's notions already alluded to.

We might also point out that a very important part of learning to play a musical instrument, such as the guitar, is the feel of the fingerboard and the ways of holding the instrument and touching its various parts. In Spanish the word tocar, "to touch", means also to play a musical instrument.

Could this have anything to do with the lack of interest in the Thereminvox, the only musical instrument which is played without touching it? (No, we do not exclude the singing voice. We have internal senses which inform us of the state of the lungs, diaphragm, vocal cords, mouth, etc. and thus in effect we are continually in touch with our voices, as much so as with regular musical instruments other than the Thereminvox.) And don't forget how sound-vibrations pass over into feeling; we feel the floor shake, for instance.

Back in 1938 there were some experimental installations in San Diego of dance floors and the like which were attached to high-powered (500 watts or so) loudspeaker driver units, so that the floor literally beat time to the music, and one's feet were actually massaged and tickled as one walked across it.

On several occasions, theatres have been equipped with an infrasonic vibration-generator of some kind to shake the floor and walls. Usually this worked only too well, creating panic and emptying the house right away quick. One such scheme involved a special extra-long organ pipe. The panic that comes from an earthquake is something like this. Also, the rolling of a ship involves a powerful tactile sensation.

And then there are all manner of exasperating practical jokes that use—or shall we say, abuse—tactile sensations: itching-powder, the flutter-buzzing-handshake-gimmick, the spray of cold water, the hot foot, etc. No, we don't like practical jokers any more than you do; we agree they are just horrid nasty persons, but mentioning this vulgar aberration does serve to point out an important characteristic of the tactile sense(s)—it—or they-are present all over the body, not just at some limited spot such as the eyes, nose, or ears.

That time-beating floor is perceived through the feet, shod or not. The synthetic theatrical earthquake is perceived, just like a real temblor, by the midriff if one is sitting down, by most of the body inside and out if one is lying down.

We can't turn off our touch as we can close our eyes; all we can do is fatigue or numb it.

Getting down to brass tacks, the nitty-gritty of it, the cold facts, a piece of tactile art has a good deal of potential resources to work with, after all.

The present writer's first tactiles have been constructed on old ironing-boards, which now may be dedicated to aesthetic causes now that permanent-press clothes have become the order of the day. Also, there are two sides to an ironing-board, so tactiles need not take up too much storage space.

Many different materials can be used, such as coarse and fine sandpaper, cloth--again coarse and fine, --metal, slippery plastics, cold, medium, and warm-feeling plastics, leather, buttons, nails, wooden shapes, possibly even tacky and wet surfaces.

Also, the feeler—we can't say viewer or audience, can we?—may take the tactile in his own order, "play" it like a keyboard, use the forearm or elbow if he wants, or the back of the hand.

With modern gadgetry, vibrators and motion--one artist has suggested a conveyor-belt—are feasible.

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There have been some experiments with wind, such as fans and air--jets of various kinds. This is a convenient way of evoking tactile and cold sensations over different areas of the body--with a hair--dryer contraption one could warm the air to get neutral or heat sensations---but let's not go in for that: there are too many blasts of hot air inflicted on the public as it is!

In this Electronic Age, someone is sure to bring up the use of electricity. This, alas, brings up that irritating Therapy bugaboo again--as is well-known, the medical profession tried out many electrical devices in the early 1900's without too much in the way of conclusive results, so the matter was quietly dropped.

Unfortunately, the popular desire for miracles and magic cures aroused the greed and money-grabbing instincts of hordes of quacks and shameless fakers of every possible description--and they are still at it, foisting worthless electrical gadgets on the public. Worse yet, many quite sincere people have deceived themselves into believing they had invented an electrical cure for something. As a result, most of our readers will have experienced the peculiar tingling and tickling tactile sensations some of these shocking machines can give.

With the latest battery-operated circuits, it might be possible to build a safe device that would be usable in tactile art---but on the other hand, it is probably inadvisable to reduce anyone's fear of electric shocks---this is one of the few <u>useful</u> fears, since many more shock hazards exist today than were even dreamt of in past years. We only mentioned it because someone else would bring it up anyway if we didn't, and this is the right place and time to cast a NO vote against it.

Also, some of the tingling and tickling sensations could be elicited by purely mechanical devices that would cause a beard to vibrate, or a table-top or something similar.

Tactile art lends itself to the construction of long narrow articles, such as wooden or metal or plastic rods or railings, so that one could walk the length of a room or corridor. Indeed, rods for both hands could be provided, to walk between. This should be obvious, from staircase and balcony railings, newel-posts, etc.

....All right, if some of you are going to keep insisting upon utilitarian ulterior motives, how about this one: With the increased production and exhibition of tactile art, the general public will finally rise up in protest against common objects of tactile torture, such as tight, constricting clothing, those wretched miserable folding chairs, inhumanly-hard benches and seats that must have been designed by a bunch of sadists, and improperly-shaped and rough handles for tools, ...and put a well-deserved end to such things. No wonder some people are irritable at the end of the day---they have a right to be, putting up with these needless annoyances.

For some people, mention of tactile art immediately starts them off on a digression into combined art-forms--that is, they don't want tactiles to stand alone, but to be tied in with something else, such as light and sound effects. The present writer believes that 'one thing at a time' is a wise policy--to make worthwhile explorations in a "new" field like this, one should consider first purely tactile art before trying to combine it with everything else under the sun. A case in point: The art of colored light, or <u>Lumia</u>, as it is sometimes called, has been held back by always accompanying it with music or sounds---it should first be developed <u>in silence</u>, before one attempts hitching up the two- or three-art team.

In closing, we should point out that "aesthetics" comes from the Greek word for "feeling", αἴσθησις, *áisthēsis*.

Little and Big Brother Are Both Watching You!

It is difficult for us, who were brought up on George Orwell's book and the hundreds of reviews of and allusions to it, to realize that way back long ago, 1984 was just another number, not a worldwide fear and apprehension symbol, as it is now. Yet it may all turn out for the best--Orwell's warning about the totalitarian state has been taken so seriously by so many people that when the year 1984 actually arrives, the dreadful events forecast in the book may have been prevented.

However, in order to bring this desirable eventuality to pass, we should get over our fatalistic despairing numbness produced by Orwell's fictional account and some other doomsday stories, and consider some of the smaller problems that were written about in the stories, but consider them in their present-day context, where we can hope to do something about them long, long before 1984 arrives.

A few years ago, the all-pervading influence of the computer reached the point where the Invasion of Personal Privacy became a serious threat and a subject of serious discussion.

The poor, mindless computer has been seized upon as Official Scapegoat in this 1984esque drama, when it is at worst a passive catalyst, speeding up a process it did not originate.

Stories of doom created their oppressive, obsessive, frightening atmosphere long before computers were under development: how about Aldous Huxley's Brave New World? Or would his Ape & Essence have scared you any more, had it been full of computers?

To put it another way, the anti-computer people try to argue both ways at once: they say the anonymous impersonal machine reduces you to a mere number, but in the very same breath they accuse it of snooping into your personal secrets. Now how can an "anonymous impersonal number" also be a "gossipping tattletale"? That just doesn't add up somehow, on or off the computer.

The machine is made the scapegoat so that the heat will be taken off the people responsible.

Furthermore, the computer proper is a processing unit; it doesn't have a long-term memory like a human brain. The data it operates on have to be fetched from external memory-stores, and to be any use after the computer processes them, they have to be output and stored somewhere outside the machine. This may be on magnetic tape, punch-cards, printout, or on microfilm and other sophisticated forms of storage.

While such data may be stored as ordinary print or typewriter-style printout, often it is in code, "machine language" or entirely invisible like the magnetized areas on tape, which can only be read by special machines adjusted to that particular code. Why do we go into such technicalities here? Because this is relevant to the private individual's--your!--attempt to find out what the owners and users of data systems know about your private affairs. You can see that an item of information may appear under various guises other than plain English letters: invisible magnetizations on tape, holes in punch-cards or paper tape, and many other forms, including new ones as they get invented and put on the market. Even trained personnel could not be sure how many places a particular item, such as something about you, which may be true or untrue or contain garbling errors, has been recorded, and they might not be able to read it if they did know where it was stored.

But that's not the half of it! Data may be sent by telephone line, teletype, radio link, or satellite or cable, to other cities and other countries. To try to trace it is like the old story about the woman who tried to get all the feathers back into the pillow: only in this case, some of the feathers were magically changed into spiders or flies or gnats or thistle-seeds or hornets.

The threat to one's privacy is thus not posed by the computer per se, but by the new capabilities of feeding data through extremely complicated and extensive interlocking communication systems. This can result in the formation of gigantic data-banks or super-dossiers, when too much confidential information about a person gets compiled and put together.

The almost impossible time some people have of correcting misinformation in credit files, shows that it may be too late to recover our former state of privacy, but at least there is hope of

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LITTLE & BIG BROTHER ...

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applying the brakes and clamping some restraints on the present runaway situation. It may sound paradoxical, but what we need to protect our privacy is to subject the privacy-invaders to merciless publicity.

Why do we say "Little Brother" as well as "Big Brother"? Because the same business interests and various kinds of organizations(which may not be commercial) will accuse the Government of being Orwell's 1984 Big Brother, while at the very same time they may be snooping on defenceless private individuals in a manner the federal or local governments would not dream of doing.

The sordid story of credit applications, school records, employment applications, special investigators quizzing neighbors and making all kinds of phone calls, is so well detailed in various books and magazine articles that we needn't elaborate here. Such books as The Organization Man, The Naked Society, The Privacy Invaders, The Pyramid Climbers, Life In the Crystal Palace, and others, will show how serious the situation was before the interconnection of data-processing facilities became a reality.

If all the information in such files were truthful and accurate, it would be bad enough, but alas! any mistake or accidental misprint has a way of propagating itself, and popping up at the most inconvenient time.

Or place. If information is sent two or three thousand miles from where it was gathered, as part of a large "shipment" of electronic impulses, the persons in charge of a data-store at some distant place have no way of knowing that one item is authentic and another is mere electronic noise.

As we move deeper and deeper into the communications era, Information becomes more of a commodity, taking the place formerly occupied by gold, silver, and gems.

But with this important difference: Information--knowledge also--cannot be hoarded unchanged for years as gold or diamonds can. The recent history of so-called "atomic secrets" should be proof enough of that! An 1870 encyclopaedia or chemistry book or treatise on physics looks almost ridiculous today, yet it was the best truth obtainable when it was printed.

Similarly, it is monstruously unfair to use unfavorable school records of 20 or 30 years ago against someone today, when they are in an important sense not really the same person: people change greatly in real life, unlike the characters in stories, who usually remain the same.

Thus when personal dossiers are compiled from past records of widely different dates and qualities and places, the picture of the person is bound to be ridiculously garbled and distorted. The machine doesn't know this, of course, and it can't care. Perhaps something like the legal principle of the Statute of Limitations could be extended to cover this unhappy situation.

We should look to legal remedies for some of these problems, because a movement has already begun to gain a legal status for the right to privacy. Since the lawmakers are individuals too, with their own interests to protect, we may expect a considerable amount of coöperation in this regard.

Another reason we should seek legal restraints on the misuse of private information is that organized crime could become very formidable if they get control of data-banks and start using this information to blackmail people, and to rob them. Since it is well-known that they use legitimate businesses as "fronts", it should be painfully obvious how easily they could gain access to computers, data storage centers, communication networks, and facilities-for-rent (time sharing).

That is, information gathered by quite honorable enterprises for quite legitimate purposes can be misappropriated and used by unscrupulous persons or groups. Worse still, tapes and other storage media can be copied without any trace being left of the fact that they were copied.

While it is true that all kinds of security measures are taken to safeguard computer centers, it is equally true that what man can conceive, man can defeat. And there are clever impostors who manage to put over their tricks quite a while before being caught.

This is only a hurried, sketchy introduction to a very large subject. We will have to continue this discussion in later issues; indeed, we may be able to get a contributed article from someone.

Forewarned is forearmed, and the general public should be aware of this new threat. The awareness of it is itself some safeguard. And be thankful that Hitler and Stalin didn't have computer networks!

MEMORIAL EXHIBITIONS CONTEMPLATED LATER ON

The editor's mother, Yvonne Darreg, passed away in January, 1969, after a long series of illnesses and relapses. She was approximately 83. Since the editor was also quite ill, and his recovery was slow, it was not possible to plan for any suitable memorial.

Yvonne Darreg was born in Menominee, Michigan, and studied art quite early. After her marriage in 1905, the editor's parents went to Europe and spent considerable time in Paris, and had brief visits to Germany and Italy. They both studied at the Sorbonne in Paris (the editor's father earned a degree in history and taught for some time at the University of Oregon, both the main institution and the Portland Extension).

Yvonne Darreg's Parisian art studies included the Julien school, the Académie Delacluze, and sculpture under Rodin. She met many of the notables of the time.

Around 1907 the family settled in Portland, Oregon, and when circumstances and health limitations permitted, she continued painting and drawing in watercolor, oil, and pencil, as well as a considerable amount of sculpture and china-painting. Coming to California in the mid-1930s, unfortunately most of her works were lost in moving and storage, a blow from which she never really recovered. She produced some drypoint etchings and further paintings and drawings, the most recent being a set of watercolor portraits around 1950. In their turn, some of the later works have been lost.

What few items remain are not framed or mounted, and in many cases the present owners cannot be traced. However, enough could be borrowed to assemble a representative exhibition, if suitable temporary mountings and frames could be borrowed for this purpose. Perhaps someone among our readers, or their acquaintances, has had experience in how to arrange a memorial exhibition.

Obviously, such events have to be planned long in advance, and we will not be worried or disappointed if it takes several years to arrange exhibitions, so long as they take place eventually. It would be desirable that memorial exhibitions be held in Michigan and Wisconsin where she first studied, in Paris, France, and in Portland, Oregon where most of her life was spent, as well as here in Los Angeles and in San Diego and San Francisco.

The works are representational, so should not be exhibited with modernistic paintings, although a place which showed Impressionist works would be quite congenial.

Unusual Instruments May Be Heard and Seen in Hilltop Studio

Regular readers of this journal may recall the item in a previous issue about the amplifying clavichord, which was severely damaged by the movers who brought it here from the condemned house on Exposition Boulevard four years ago, and then during the ensuing three weeks we were unable to get it into the garage for storage, so that the further damage from the weather and various persons intruding into the open back-yard became very serious.

Indeed, the instrument was left a rusty, torn, hopeless, mutilated wreck. It had to be stowed in the garage and forgotten—it was completely unplayable. While there were two responses to the news of the damage, nothing whatsoever was done about it—until nearly three years had passed, when Ervin Wilson arranged for the re-welding of the metal frame of the instrument and its transportation to and from the welding shop in North Hollywood, quite some distance from here.

The re-welding of the frame corrected two design errors made in 1940. Month by month, the work of rebuilding has proceeded satisfactorily, and soon the instrument will be playable from its 7-octave conventional keyboard once more.

However, there has been a most unexpected and remarkable 'bonus dividend' from the rebuilding operation: *the instrument is usable even before it is rebuilt!*

Picture, if you can, a steel frame eight feet long and four feet wide in front—i.e. almost as big as a concert grand piano. Until just a fortnight ago, there was no keyboard attached to it—only a wooden sub-frame and structural members. However, all 158 of the new strings were installed, and tuned to an overtone-series (not the ordinary musical scale, although it contains most of the notes in that scale) and these strings are mostly quite thin, like mandolin or guitar strings: none of them are wound—this is the reason for the 8-foot length—to avoid the inconvenience and expense of experimenting with five or six sets of specially wound-to-order bass strings, which would have had to be discarded and their successors discarded.

Unlike piano or harpsichord, a clavichord has *automatic dampers*—not a damper mechanism, but thr or four long, heavy strips of felt woven between the strings at one end, to stop the tones quickly immediately the keys are released. The hammers that strike a clavichord's strings are of metal, and are *bridges* as well as hammers: if you have access to an electric Hawaiian steel guitar, hit the strings with the "steel" and listen to the effect. (Continued on next page)

UNUSUAL INSTRUMENTS...

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The clavichord went out of use before the harpsichord did, because of its extreme softness, and so the harpsichord revival movement of this century has not done much to rekindle interest in the clavichord. Rather, the new life and growth of the harpsichord has only added to the widespread confusion of just what a clavichord is.

It has been an uphill struggle, the last 30 years from 1940 to 1970, for this writer to explain why a clavichord is desirable, and beyond that, why an electrically amplified clavichord designed without a soundingboard and with steel strings and steel tangents throughout rather than the brass tangents and partial use of brass strings that was customary in the clavichords of Bach's time and before.

What's a *tangent*? Latin word meaning 'touching', applied to the metal bar sticking upward from each clavichord key, which touches the string and stays against the string for the duration of the tone. As we said above, the tangent is at once hammer and bridge: *where* it strikes the string determines the pitch of the note, exactly as where the 'steel' is placed along the strings of a Hawaiian guitar determines the pitch of its tones. This means that on the compact designs of conventional clavichords one could economize on strings by having two keys or even three keys hitting the same string or pair of strings in *different places*, since one was not likely to sound B and C together in the bass octaves, and a tone-cluster like G, G♯, A, and A♯ was highly improbable, to say the least!

Since the tangent is at once hammer and bridge, and since the other end of the string is heavily damped with felt, the tone stops instantly on releasing the key, as compared with the after-sounds of piano and harpsichord. This makes for clarity. If the key be depressed harder than is necessary to sound the tone, the string is *stretched tighter*, sharpening the pitch. This means an individual, expressive vibrato is possible. This is the *raison d'être* of the clavichord, what it can do that the piano and harpsichord can never do, and the organ's automatic tremolo imitates only poorly.

The educated, historically-devoted musicians and listeners think of the clavichord, if they know what a clavichord is, as a museum-piece for the authentic performance of early compositions.

The idea of amplifying it, or using it to play new music, gives such backward-looking people an unpleasant shock, so they sneer and pooh-pooh it.

Such has been the situation until a few months ago—only the last six months out of the thirty years the Darreg amplifying clavichord has been in existence, has the situation changed. But now it is quite another story.

The electric guitar has conquered the world. You have but to turn on your radio, and no longer does the piano monopolize the scene. Also, the temporarily eclipsed Hawaiian steel electric guitar is coming back into favor. Guitars by the millions are entering homes and apartments, in many versions, electric and acoustic, with different kinds of strings and widely different tone-qualities. To make up for the lack of the piano's "loud" pedal, synthetic reverberation is found on many guitar amplifiers; some kind of tremolo, usually reminiscent of the first electronic organs, is also often fitted. Then there is the fuzzbox.

As recently as five years ago, who could have predicted that the general public ear, not only that of the specialist, aficionado, or dilettante, would be so re-conditioned?

Now it so happens that the timbre of the amplifying clavichord belongs to the same 'family' as the various guitars and certain other fretted instruments, so here is a splendid unexpected opportunity, and we mean to take full advantage of it.

A full seven-octave keyboard can do much more than the six strings of the guitar, so that should be justification enough for the existence of this instrument. However, it should be pointed out that there is a great opportunity for composers and arrangers to produce works for several guitars, and preferably including electric basses to extend the lower range and mandolins or similar instruments to extend the upper compass. This is not a case of either-or; it is an expanded opportunity for both-and.

On the last page we alluded to the capabilities of the amplifying clavichord even before it was rebuilt. Without the keyboard and without the muting-felts, we have to all intents and purposes a 158-string psaltery, zither, and sitar, with the bass strings 7 feet long! Since there is no soundingboard, the tone lasts and lasts. The strings can be plucked or struck with wooden hammers as in the dulcimer, so they were tuned to an overtone-series to permit a wide range of sympathetic vibrations.

Furthermore, the metal frame itself may be struck with drumsticks or various kinds of wooden, plastic, or metal mallets to elicit a wide range of percussive rhythmic effects, *accompanied by a long-sustained reverberative echo.* Pending the re-installation of the electromagnetic pickups, these effects have been tape-recorded in stereo --since unfortunately all these unusual sounds will be unavailable after re-installing the muting felt strips for conventional keyboard playing of the instrument. Quite a number of visitors have come to try these effects for themselves.

The infatuation of some people with Oriental and exotic instruments, especially those from India, has also made for a greater appreciation and understanding of clavichord and psaltery tones.

It behooves us, then, to contemplate building some kind of large psaltery and other instruments so that these effects can be permanently available. *(Continued on Next Page)*

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To further this aim, copies of the tape recordings have been loaned out, and more copies will be sent as funds and time will permit. From the enthusiastic reactions of many listeners so far, it is practically certain that co-operation can be secured to build such instruments, whether here at this studio or merely under our occasional supervision and consultation. Why special one- or two-of-a-kind instruments? Listen for yourself; no longwinded argument is necessary. It simply is not practical nor financially feasible to incorporate certain unusual features into mass-produced instruments. But through tape and disc records and the new cassettes and cartridges, everyone can hear them. Also, if a few instruments are built, they can be rented out, or time on them at recording studios can be rented.

The design of instruments for mass production, and the modification and improvement of existing instruments, and-or the fitting of accessories and attachments to them, is another matter. It will be our concern as electronic music consultant to assist on such problems, leaving the other factors in the given situation to the engineers and other manufacturing experts. We have the missing pieces to many electronic and conventional-acoustic instrument puzzles.

As for conventional clavichords, which have a four- to five-octave keyboard and are usually small and compact, with a weak tone barely audible outside a medium-sized room, there is a future for them, now that the "classical" nylon-stringed guitar has developed an interest in baroque and renaissance music for the home, and now that so many people live in small apartments, mobile homes, trailers, campers, etc., or are not allowed to disturb neighbors when practicing at night, or are constantly 'on the go' and thus need something that can be tucked into a car and taken anywhere. Whether there will be much demand for a portable amplifying clavichord, a scaled-down version of our large instrument, remains to be seen; but from such discussions as we have had lately with knowledgeable persons, it looms as a definite and attractive possibility.

The crassest and crudest of financial considerations will determine whether the extra refinements of an amplifying clavichord with real strings and the intimate expressive touch of the performer's fingers directly communicated to those strings, will be practical in an instrument for quantity manufacture, or whether it will be economically more expedient to *simulate* and imitate these characteristics in a portable compact electronic organ equipped with percussion effects: such organs are the very next thing on the market after the growing success of the so-called 'combo' organs now seen and heard all over.

The present writer has already begun to compose new pieces and to arrange his older compositions for these portable electronic transistorized 'combo' organs, since they appear to be the logical successor to the piano as home and school instrument (the concert grand will continue its lofty status in the concert halls and auditoriums dedicated to 19th-century dead composers).

He hopes to be involved in the further development and research on, and expanded use of, these new instruments, whose economy and convenience and portability will endear them to the "now" generation.

More about combo organs, and electronic organs generally, will appear in later issues, but this much here to make it clear that we are quite impartial, un-obligated, and un-committed as between the quantity manufacture of such organs with imitations/simulations of clavichords, pianos, and harpsichords, and the production of amplifying clavichords close to or far from our 1938 design. We are not ignoring the existence of such instruments as the "Clavinet" either, but it is quite impossible to give a written description of the many differences between these instruments and the amplifying clavichord—a face-to-face conference and models demonstrating the tone-production-principles would be required.

There are enough different styles of music and kinds of people who play them, and enough different nations and cultures and subcultures in the world, that there should be room for many kinds and subtle varieties of instruments.

In our studio, we have the loan of several instruments of highly unusual nature, such as the Grayson-Wilson 48-string psaltery with sound-chambers and adjustable bridges; and two guitars re-fretted to the 17- and 31-tone systems respectively, this besides our own guitars which have been rebuilt to the 19-, 34-, and 22-tone systems.

Also there is the Schafer Undevigintivox, built some 20 years ago, consisting of 77 steel bars tuned to 4 octaves of the 19-tone system; we plan to remount it and expand it to 5 octaves. There is a 5-string amplifying cello as well as a regular cello, an electric keyboard snare-drum, an electronic keyboard oboe recently overhauled, and a specially-designed electronic organ quite unlike any other.

"Surplus" electronic apparatus has recently been acquired and donated, from which will be made extensions to the organ and necessary repair and test equipment. The object of this studio is not rehearsal for concert-hall recitals and all that stuffy stuff, but rather tape recordings for tape machines in listeners' homes, livingroom to livingroom without the 19th Century's fuss and ceremony and ritual and formality. That other world will be left strictly alone for its admirers to enjoy undisturbed by us.

NUMALITTERA & NUMAUDO NEWS

The long and unavoidable delays in getting out this issue of the Ex-Exposition Boulevard Exposé ortunately do not mean that the progress of our Numaudo system for spoken mathematics and symbolic logic has been equally slowed down or delayed--on the contrary, we are happy to make a sort of Progress Report.

An audiovisual Aids Laboratory on the East Coast supplied us with a set of 90 projection-slides and a script for sample first lessons in Numaudo, together with a sample tape having slide-changing signals on it. Thus the system can now be promoted to the audio-visual-aids industry, whose capital, like the movies, is Hollywood, so we are in exactly the best possible place for such promotion.

Therefore we earnestly solicit "interfacers": people who have contacts in the Los Angeles area in the Audio-Visual-Aids field and allied educational activities. Right now is the time to see that Numaudo becomes a profitable and highly useful system.

An extremely important decision was made about a year ago: as you know, there are two types of people, sometimes called "audiles" and "visiles", or ear-oriented and eye-oriented, or those who prefer to hear things and those who prefer to read things.

Now, between 1958 and 1960 a book was written and published and sold out, called simply NUMAUDO. But the visually-oriented persons who bought and read the book evidently didn't get the crucial idea: that Numaudo, Numbers made Audible, is a spoken syllable-system, not a written code.

Our important decision last year was to split off this written code and promote it to visually-oriented persons, so it has now its own name, Numalittera--from the Latin words for Number and Letter.

Since this is written on an ordinary typewriter, let us describe Numalittera: It is a second-order code. More to the point, it is a typewritable, printable code.

So what? So any ordinary typewriter, even this 50-year-old Remington #12, that doesn't even have any "plus" sign, becomes a mathematical typewriter. But that, perhaps, is not the main point.

Teletypewriters are found everywhere. All kinds of new keyboard machines are proliferating like rabbits and mushrooms in offices, computer centers, and many other places.

There are even new alphabetical keyboard machines for hunt & peck people who don't know touch-system typing--the keys run A B C D E F G instead of Q W E R T Y U I O P .

There are remote terminals for entering data into computers, or for converting written information into weird "peeping" noises that can be sent over telephone lines to distant cities--these machines have typewriter-style keyboards.

Over-optimistic science-popularizing writers of the "Sunday-supplement" variety keep predicting that such typewriter-like machines will be in many homes. We are not that optimistic, but these machines are getting into schools--and that emphatically includes elementary schools! Quite young children are being exposed to them.

Now it is true that some of these machines have extra keys, but most of them do not have any real repertoire of mathematical signs, let alone symbolic logic, and hardly any have the little tiny numerals above and below the line of printing used for subscripts and exponents.

Even when they do have extra keys the touch-system typist, like yours truly, would have to stop and break the rhythm of typing and guess where omega or xi or the radical sign was. On the Varityper, which has changeable type and a considerable number of such special signs, so much time is wasted putting on and taking off the special type-plates that it is slower than just plain old clumsy writing by hand!

The "Typit" attachment is also very slow, and handwritten inserts are atrociously sloppy-looking. On the teletypewriters abovementioned, you can't write-in at all.

(continued on next page)

NUMAUDO & NUMALITTERA NEWS

(continued from Page Seventeen)

On the keyboard card-punching machines, the available characters are quite restricted. Most computer printouts do not have a wide range of characters--often printing capital letters only.

While the newest magnetic-tape codes provide a good-sized set of characters, seldom will these be available to express all mathematical signs, and certainly not logic symbols.

Even if a complete set of mathematical and logical characters were available everywhere and on all the different kinds of machines it might be used on, many otherwise skilled typists would not be able to type them fluently at the high speed and with the very high accuracy that can be attained in touch typing of "straight matter" such as we are typing right now.

Typesetting costs and proofreading costs for books and pamphlets and magazines containing more than a handful of mathematical symbols can be incredibly, fantastically high. We shudder at how many times

10^{14}

gets printed as "1014". More than once we have seen

$\sqrt[12]{2}$

which is an important number for conventional keyboard and fretted musical instruments, printed as "12-√2" or even "12√2". So the cautious author will translate it into metaphorical longwinded circumlocution as "the twelfth root of two" in the hope the compositor won't defeat him.

We are proposing that in such cases, where characters are not on the keyboard, that such characters be encoded with Numalittera. For instance, the example above would come out: rusazerazere, which as you can see, takes less time to type than any known method of typing or writing by hand or pasting in the symbols. Any touch typist, even one ignorant of the Numalittera code, could type this at almost normal speed without stopping or breaking the rhythm. Just as easily as he or she could type "Jim Robertson" or "Richard Harvey."

More importantly, it would cost less to get the publication out, especially where time was a factor. Admittedly, rusazerazere, or the alternative forms ru12ra2re or ru saze ra ze re, takes up more space on the page than $\sqrt[12]{2}$, but typing it or typesetting it takes no more time. Less time, usually. Remember that one has to slow down or stop for the special characters. (There would not have been any significant difference if we had expressed this particular number with a fractional exponent; our argument still obtains with the same force.)

Where do we get those groups of letters? Numalittera is simply the phonemic transcription of Numaudo syllables. It was not necessary to invent a special typewriter code that would be unpronounceable; it was merely necessary to write the accepted internationally-used letters to express the sounds that make up the Numaudo syllables.

That is, the Numaudo syllables stand for the ordinary mathematical symbols and numerals; the Numalittera letters stand for the Numaudo syllables, and are thus a second-order code.

It should be quite obvious that Numalittera would never be used in handwriting. The existing mathematical notation was invented by people who wrote by hand, long before typewriters were even dreamt of. Some heckler is going to accuse us of trying to abolish conventional mathematical notation--there is no such intent--merely a desire to help people get more use out of existing keyboard machines.

The so-called "computer programming languages" have far more awkward and hard-to-remember codings than any found in Numalittera, and they take longer to learn and are often unpronounceable, whereas the Numaudo syllables from which Numalittera is transcribed are pronounceable by people of any nation on the entire globe.

A preliminary pamphlet on Numalittera is available on request as long as the supply lasts; leaflets will appear soon.

Numaudo leaflets are also available, and tapes can be made to order. (continued on next page)

NUMALITTERA & NUMAUDO NEWS

(Continued from Page Eighteen)

As soon as the co-operation of people with trained speaking voices can be obtained, record discs and cassette tapes can be prepared with Numaudo instructional material. For the present, reel-to-reel tapes are available with explanations and examples of Numaudo.

Just as the Numalittera second-order or derived code is designed for typewriting and the users of other keyboard machines, the Numaudo system of spoken syllables is designed for voice communication, especially over the telephone.

When the conventional mathematical notation was devised--actually it is a slow growth to which many persons have contributed--telephones were only a utopian dream.

In the time of Leibniz or Newton or Descartes or Huygens, nobody's studies or ruminations or handwriting of notes were ever interrupted by a nasty, jangling telephone bell. Life proceeded at a leisurely pace. The general public knew no mathematics beyond simple arithmetic. Thus the question of having actually to speak algebra never came up--if the other party was within earshot, he could look at the blackboard or paper; if he was farther away, then a letter could be sent.

It is difficult to imagine it today, but no-one was in a hurry. The typewriter might have been invented a century or two earlier than it actually was, since the equally complex harpsichord and organ were in existence, but why bother? since nobody was in a hurry.

In the days of the silent movies, a sure-fire comedy gimmick to get the audience to laugh was to show a few moments of fast-motion film, with people dashing around and doors slamming madly and everything jumping up and down faster that you could see it, almost.

Ever wonder why this kind of gag isn't funny anymore? Why don't you see it on today's movie screen or your livingroom TV? Because it is too cruelly realistically like the hectic breakneck pace at which we live today!

Consider for a moment why this paper exists. Bluntly, there just isn't time to write 200 people individual letters, yet there is more happening now than ever before in history, and what happens, happens five or ten times as fast. Again, why is this issue so late in coming out? Because there is too much else to do, and so little time to do it in.

Why are some of the sentences rambling or obscure? Because we would never get the paper out at all if we stopped to write rough drafts and polish and revise them. And 'fess up now: many of you are skimming or speed-reading this!

This is the context in which Numalittera and Numaudo must be evaluated, not the leisurely world of Shakespeare nor even that of Dickens when a novel could go on for pages of longwinded static description. Indeed, do not evaluate Numaudo or Numalittera in terms of your own childhood experiences with arithmetic in the grades.

Within just the 25 years that the Expose has been issued, the speedup of everything has been truly terrific.

So whether Numaudo was necessary in 1930 or 1950 or even 1960 has no bearing on how valuable it could be in 1970, and as for 1980.....!

Do you realize the extreme pressure put on even little children today? How they are rushed through lesson after lesson with no time to think? And how much pressure there is on adults too, to keep up with the times and digest all the technical information about subjects that didn't exist in 1940, or had no names if they did exist?

If there isn't time to write a letter, and you can afford it at all, you telephone instead. Since the world we now live in runs on mathematics, a telephoneable math is now a necessity. And that is what Numaudo is. Not a language. Merely the spoken form of an already-existing international written language that most people will have to know. Namely, the conventional written mathematical notation. Who would have time to learn contemporary mathematics and

(Continued on Next Page)

NUMAUDO & NUMALITTERA NEWS

(continued from page 19)

symbolic logic thoroughly enough to be aware of all the shortcomings of present mathematical notation, and then also be able to extrapolate to the requirements of future mathematicians, and then set about constructing a better notation than the present one, with this added requirement: that it be a complete "language", i.e. speakable as well as writable and printable, as opposed to the present written-only mathematical "language", which has no legitimate spoken form?

Obviously this is beyond the powers of any one person. You saw it was impossible before you finished reading the question.

All right, how about a committee? Somebody is sure to bring that up; indeed they already have, several times. Do you seriously believe that Prof. Zweistein and Dr. Pantagnost and Sir Algorithm and Prof. Infinitudington could afford to, or even would be allowed to, take time from their extremely busy schedules to get together and thrash out a new notation? Knowing committees as you surely do, would they ever agree?

Well, then, how about putting the problem through a computer? Please go away and get lost; you have been reading too much science-fiction! Besides, computers have no aesthetic sense; and furthermore they can't handle all the signs of the existing notation. Most non-arithmetical problems have to be translated into a peculiar kind of arithmetic before the computer can do them--this is what programmers are for.

Looks like an impasse, doesn't it? Maybe that's why it wasn't done before. Anyone reasoning as above would have a perfect right to give up.

Fortunately, it is not necessary to devote a whole lifetime to solving the mathematical-notation problem, and it is not necessary to summon a committee together either. All that had to be done was to go back some nine hundred thirty years to Guido d'Arezzo's solfa system and steal his basic principle!

"Will Numaudo work?" or "Is spoken mathematics practicable?" are questions that have been flung at us for quite some time now, often with the implication that a few million dollars would have to be spent on a feasibility study and a pilot teaching-and-learning trial. Sometimes the implication is rather that Numaudo (and/or Numalittera) must be difficult to learn.

To the first contention: Anything that has succeeded for 930 years with children as well as adults, and is still going strong in many countries, must be considered well-tested, tried-and-true. Numaudo's basic principle, just as Guido's, is that syllables may stand for mathematico-logical entities and relations. Yes, that's right: Guido used UT RE MI FA SOL LA not for absolute pitches, but for a set of relations among a group of sung tones. (Absolute pitches were denoted indirectly by a kind of implication. What modern Italians do with these syllables is not relevant to the eleventh century.)

Believe it or not: Algebra and symbolic logic have been sung by means of syllables all these centuries, whether the people concerned knew it or not.

So many people have learned and used solfa in school at an early age that it must be easy to learn.

To prove that Numaudo was easy to learn and that it would work cost nothing--just two people to try it out about two years ago, so the matter is definitely settled.

The mental block, the notion that Numaudo would be difficult to learn, may have come about this way: If one misunderstands Numaudo as being a language rather than a system for speaking an already-existing written language of quite small vocabulary, then one's unhappy experiences with high-school French or Latin cloud the issue. Numaudo is as simple as do re mi fa, which you learned in grade school. If the notion stems from unpleasant ideas of the difficulty of mathematics, mathematics was difficult because it was unspeakable. Numaudo makes it easier. In a few days you can find out for yourself by learning 20 of the syllables. So what have you got to lose?

# # # #

Wealth Amplifiers

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Many of today's spectacular success stories are based, not on some new mechanical or electronic gadget, nor on any novel chemical substance introduced to the market, but on the creation of some system, skill, or technique, some method or program that carries with it a new mental attitude.

A wealth amplifier is any affair of this nature, which increases the value of something else. Indeed, most wealth amplifiers allow you to get more "mileage" out of equipment or facilities you already have, without having to spend more on them or having to put any more investment into them.

For instance: the touch-typing skill is a wealth amplifier, since it more than triples the wordage output of a typewriter in a given time. But it's still the same machine, the same typewriter with no changes whatsoever in its mechanism.

If you are trying to sell a piano, the price you can get for it will be as much as two or three hundred dollars less, if it happens to be out of tune. The piano-tuning skill is thus a wealth amplifier.

The special coding systems called "languages" by computer programmers, such as Fortran, Cobol, Algol, etc., are the latest kind of wealth amplifiers, since without them a computer would be a useless pile of wires and gizmos.

We could go on and on to pile up an impressive list of wealth amplifiers, both contemporary and historical. For instance, the wires and apparatus required to construct a telegraph system were useless and pointless without the Morse Code to send messages over the wires.

The closest chemical analogy is the catalyst, a substance which is not used up in a chemical reaction, but without which no profitable transformation of the raw materials can be made. That is, hitherto useless chemicals--even waste products--become valuable wealth-producers as soon as the right catalyst is found.

People interested in biology will of course recall hormones and enzymes. But a closer analogy would be a trained animal as contrasted with an untrained one. As dogs and horses have been being trained for thousands of years, wealth amplifiers (in this case, the training systems with their practical results) aren't exactly a new thing!

It follows also that the difference between a computer program and the special vocabulary which includes such code-words as Giddap and Whoa and the almost unprintable Tk-tk!, is actually very small.

In the 19th century, habits were the domain of psychology; today, habits are seen to be allied to computer programming. Now we can carry this idea a step further, and subsume both entities under the new heading of Wealth Amplifiers. This means that in the term Wealth Amplifier we have a powerful new and far-reaching generalization.

For instance, wealth amplifiers can be combined with one another; They can be of second or higher orders--i.e. with one wealth amplifier already in existence, another or others become possible where they were not possible before.

Better yet: Numaudo and Numalittera are both Wealth Amplifiers, of equal rank and potential with all those already mentioned on this page, because they can greatly increase the value and usefulness of many existing systems and equipment, and the efficiency of many persons and organizations, and create new job opportunities and room for accomplishment.

Now we have a means of proving the relevance of Numaudo and Numalittera to the contemporary scene--of showing how they belong to the total picture, and how profitable for all concerned they can become.

We will expand on this at a later date.

For the present, it is more important to move back and take a very broad, overall view: of Wealth Amplifiers in general. Here is an unprecedented opportunity to co-ordinate what has never been coordinated before. Let's set up an organization right now. (Continued)

WEALTH AMPLIFIERS

(continued from Page Twenty-One)

We wouldn't dare suggest this, unless interest had been shown in the Wealth Amplifier concept. Several persons of widely-different backgrounds have shown interest in the idea, and this despite the extremely limited circulation the preliminary description of the concept has had so far.

Since the main factor all Wealth Amplifiers have in common is that they increase the value of EXISTING equipment and facilities, and since many Wealth Amplifiers already are in existence--all we are doing is making hitherto-unconnected entities relevant to one another and pointing out the usefulness of previously unseen relationships--the activation and implementation of the Wealth Amplifier concept can begin at once!

All that is necessary is for the right persons to hear about it, and be brought together. What kinds of people? The best clue is, that we are moving out of the age of specialization and into the age of generalism. You may have seen the werd Generalist somewhere already.

A generalist is someone who can see beyond the end of his or her nose; Who can take a broad, overall view; who can resist the temptation to ignore "what's happening". It is time for such people to synthesize as well as analyze.

Those to whom the foregoing makes sense may forward their suggestions and proposals to Ivor Darreg, 3426 Winslow Drive, Los Angeles Ca.90026, in the form of brief memoranda.

Further action will depend upon the nature of the responses and the expressed desires of the respondents.

NO BOOK REVIEWS

- - - - Sorry about that!, but limited space in this issue, already double the usual length to make up for lost time, absolutely compels us to forgo the usual book review department.

Next issue will carry book reviews crowded out of these pages, but what we can do for now is to list some interesting book-titles: If you are impatient, you can look them up at your favorite bookstore or library:

A paperback edition of the late Bertrand Russell's MYSTICISM AND LOGIC is now available.

NEW ART AROUND THE WORLD is a fully-illustrated account of very recent modern art, with many of the pictures in high-quality color.

C.P. Snow, THE TWO CULTURES and A SECOND LOOK. This book aroused a great deal of comment.

THE IMAGE: OR, WHAT HAPPENED TO THE AMERICAN DREAM? News doesn't happen; it's manufactured.

John Lennon, IN HIS OWN WRITE. One of the Beatles actually goes beyond Gertrude Stein & Co.

Karkoschka, DAS SCHRIFTBILD DER NEUEN MUSIK. Fantastic collection of ultramodern oddball musical notations.

More "info" next time.

E A T

No, that isn't a sign above a hamburger joint. This time it means Experiments in Art & Technology, the title of a group headquartered in New York City and having a Hollywood branch.

One of their purposes is to form teams of artists and engineers, to collaborate on projects which may be sponsored or assisted by the companies the engineers work for.

They also have educational connections--for instance, some of their members are associated with California Institute of Technology or University of Southern California, or other famous institutions.

On February 6 of this year, the editor was taken to Pasadena by Edward Kneifel to see the E.A.T. special evening exhibition at the Pasadena Art Museum.

The place was crowded, and so the program had to run somewhat behind schedule. The peculiar three-dimensional imaging procedure called holography was demonstrated using ruby laser light. A green laser beam was reflected and re-reflected for a distance of some 200 feet in the patio of the new museum building.

A film was shown in a seatless auditorium illustrating some of the applications of lasers.

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EXPERIMENTS IN ART AND TECHNOLOGY

(continued from Page Twenty-Two)

In one of the new meeting-rooms, a purplish strobe-light flickered fitfully while somebody played background music on a baby grand.

In the interrupted light all bodily movements such as walking or lifting the arms looked unnatural and jerky.

Upstairs in the big auditorium was a panel discussion, complete with arguers and heckling questioners, which made it extremely difficult to follow the thread of the discourse.

The exhibition was complemented by the ultramodern art in the regular galleries of the new museum--and it should be noted that some technological advances, such as electric motors, plastics, new materials, and special kinds of lighting, were important parts of the works exhibited.

Jon Reuschel, avant-garde poet, took your editor to the E.A.T. "IN PROCESS"Exhibition at the University of Southern California, which was held over the Mayday weekend. (Confidentially, we suspect somebody lifted that phrase "in process" from the General Semantic books such as Count Korzybski's own Science and Sanity.)

Some collaborations between artists and engineers were actually demonstrated--big as life or bigger. There was a hot-air balloon that didn't get off the ground the evening we were there--it looked very impressive, but started listing to one side, at which a waggish punster called out: "Somebody must have discovered an effective way to combat inflation ! "

Upstairs in the Exposition Park Armory (just one mile due east of our former home that was destroyed) an artist-&-engineer team exhibited a machine which could perform unusual three-dimensional motion patterns. This demonstration was accompanied by a slide-film and a movie film, both in color and showing excellent photographic technique --but the explanation of the purpose of the apparatus was very hard to follow--no doubt because of the collision of artistic and technological vocabularies, a matter with which the present writer is all too familiar--the field of electronic music presenting unparalleled semantic problems in communication of its basic principles.

At that, there was a performance of electronic music: a light show in one of the University's smaller theatres was accompanied by a rock-type performance on a Moog Synthesizer. If only this performance had demonstrated what the symphony and musical-form analysts call "thematic development", it could have been very satisfactory.

Outdoors were set up some novel exercises in solid geometry, such as a wienerwurst-shaped plastic affair big enough to walk around in, if they had allowed this.

There was a metallic-coated mylar dome, less than paper-thin--more like soap-bubble thin, so that the slightest breath shivered it.

There was a strobelight exhibit also, accompanied by sound effects that jarred one's subconscious to the core.

And one must not ignore the Sensorium, which combines audible and visual and osmic and tactile sensations--this is slated for commercial development.

To sum up what we have seen so far of E.A.T., there appears to be a severe semantic and communication problem, which arises thus:

Each kind of scientist or engineer, has his specialized vocabulary, which is in continual flux. Each kind of artist has his specialized vocabulary, which also is changing, and continually adding neologisms.

Thus it often happens that the same word has completely different meaning in the various fields, a notorious example being TONE, which even in music, its primary field, has several unrelated meanings.

When an engineer and an artist collaborate, they are thus driven to exploit only that semantic area which they have in common, rather than to explore the wonderful possibilities of adding and multiplying their knowledges and skills.

In a word, such teams urgently need INTERFACING. They have more ideas and images in common than the divergent vocabularies would lead anyone to suspect. # # # # #

The Automated Library—How Soon?

For nearly two decades now, the overworked slogan has been "information retrieval"--with science popularizers making all kinds of wild predictions, and science-fiction writers incorporating some kind of automated library into their stories--and both kinds of writers have been equally guilty of ignoring how much all these latter--age marvels were going to cost!

When, despite the rose-colored prognostications, the pushbutton box in the home for gaining access to all the great libraries of the world didn't put in any appearance, a gloomy wave of disappointment set in, just as extreme and unreasonable as was the over-optimism of the early 1950's.

However, this is understandable: Government bureaus and foundations and impressively wealthy corporations and great universities had sunk literally millions of dollars into "crash" programs, and then the enormous investment didn't pan out, so they are justly entitled to some sour-grapes complaining.

Around 1960, your editor came within a gnat's eyelash of participating in an automated Union Catalog project--this could be the narrowest escape from financial well--being in history! His own illnesses and those of other members of the program prevented it from going through. Also, there was an incredible amount of bureaucratic red tape--indeed we are sure this is what ruined many other projects besides that one.

The extreme necessity of automating the process of storing and retrieving the immense body of information that could be available today, may stir enough people to overcome and solve the many problems involved. To do it manually would tie up more people than are available--it would come under the head of 'bailing the ocean'.

A similar emergency exists in the closely-related field of machine translation of languages. The very same unreasonable optimism in the early 1950's and tremendous sums of money poured into crash programs, and incredibly stupid predictions and statements by writers of popularized articles and the same unreasonable pessimism and reaction of disappointment and disillusionment took place in this field.

In our next issue we will go into this matter quite thoroughly —the question of machine translation and automatic dictionaries— but let's get back to our main subject here and now.

It cannot be repeated too often that there has been an Information Explosion. The growth of technical and popular publications has been fantastic--nobody can afford to subscribe to all the journals in his field, and if he did, there would be no work done if he read even a portion of them. Even the daily newspapers are so big now that nobody has time to read all of them--but they are handy to wrap the garbage in and clean up after spills etc.

Suppose you can afford to subscribe to some magazines relevant to your field of interest. Where in heaven's name are you going to put them? If you clutter up your office or bedroom or living-quarters or if a business firm or organization fills up its rooms with magazines and other informative books and publications, how is anybody going to find the right paragraph on page So-and-so when it is needed?

So things have gotten to the point where it is cheaper and quicker to do the work over or to proceed without benefit of the information, than to try to look it up or wait for someone to extract it from its hiding-place and deliver it to you.

Some of you, of course, may not be aware of how much this wasteful duplication of research, of writing and many different kinds of work, is costing us, but take our word for it: it runs into billions.

You see, knowledge and information are no longer hoardable goods like gold, silver, or diamonds.

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THE AUTOMATED LIBRARY--HOW SOON?

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Sure, they were in Plato and Aristotle's time. They were hoardable in the Middle Ages, when the monasteries and the secret schools and various archives guarded the treasures of ancient wisdom, and only the favored few were allowed to read anything.

It's amazing what a diehard this notion about knowledge being hoardable is. The professionals today often treat their clients like so many children, with an expressed or implied "You would never understand. We know best." The 19th-century notion of a class struggle and the even more vicious 19th-century notions of division of labor and of specialization, clamped this idea of hoardable knowledge down upon the populace after the Renaissance and the Enlightenment had tried to lift it.

Whole countries are still under this notion's spell. Many large organizations pretend that the 19th century is still with us, or even that an earlier century is the present.

Forty or fifty years ago, you could go to school and get trained in a trade, profession, science, or art, whether high-, middle-, or low-brow, and your neatly-packaged learning would endure the rest of your life. In previous centuries, the guilds and professions kept their specialties unchanged for generations--knowledge was so durable that it could be handed down from father to son indefinitely.

This just isn't so any more. As an aircraft executive put it: "If it flies, it's obsolete!"

What has this got to do with automating libraries? Did you think we were wandering? Well, for one thing if stored information is to be retrieved in a hurry, it has to be labelled, classified under subject-headings, correlated with other stored items, cross-referenced, and dated.

All right, say this has been done. May it rest there undisturbed for years?

It could have, in 1870. But this is 1970. To clarify this, let's consider that laser beam mentioned on Page 22.

Electronics, communication theory, chemistry, optics, mathematics, biology, crystallography, photography, and quite a number of trade skills and species of knowhow had to be put together for the first time in order to invent the laser, so that the meaning and relevance of hundreds of terms and myriads of stored items in libraries has radically changed almost overnight.

"Ruby" is no longer just of interest to jewelers; it is one of the principal laser crystals. This important new use of the material has to be reflected in the library's retrieval system--all old entries about ruby and such things as the best way to manufacture synthetic ruby crystals have to be re-labelled. Likewise for glassblowing, lenses, inert gases, prisms, mirror surfaces, high-voltage power supplies, measurement techniques, modulation techniques, and on and on.

All these changes in the subject-classifying and -relating systems in a rather short time; it can't wait!

The oldtime specialist's attitude toward this situation was summed up in his pet phrases such as "You could no more do that than go to the Moon!" ....and you know what happened to that saying.

That is, the library of the future can't remain a mere storage vault. It has to become a dynamic growing organism.

If people can't get to the library, it will have to come to them in some electronic way, not yet economically feasible, but it must be made so.

Education can no longer be contained within school-building walls and it cannot stop in adolescence. This means that people who can't afford money or time to go back to school need library services, and this in turn means that many other things besides ordinary books will have to be used.

Meanwhile, you can build your own library of paperback books and supplement it with photocopies of reference materials. Microfilm is just around the corner--a matter of getting the price down.

PIANO TUNA FISH SCALE

This is the title of one of Ivor Darreg's latest compositions, and represents a highly novel departure from the run-of-the-mill.

During the last year or so, several pianos, representing different types, such as grand, upright, and so-called "spinet", were tuned, but with this difference from the usual procedure: a tape-recorder was brought along, and the entire process recorded, along with some before-and-after playing.

Since it is possible to edit and select out and superimpose tapes, to play them at different speeds and/or backwards, and, in the process of re-recording, to insert a fuzzbox or vibrato-machine, and to extend the piano's compass to 8 or even 9 octaves, there is enough material for an "orchestration".

It is very surprising what can be done with such unpromising raw material as the monotonous, relentless, tedious tuning procedure, but then one has all the 88 notes to work with and re-combine as one chooses. And it does not sound like the so-called "prepared piano" nor yet like the ordinary electronic music studio's application of filters, ring-modulators, etc. to ordinary piano tones.

As far as we have been able to learn so far, this composition is a "first" and the audiences who have heard it do not recall anything quite like it. Undoubtedly, it will get copied and imitated as soon as it becomes more widely known. In a way, this is the last dying gasp of the piano, its swan-song, before the electric and acoustic guitars, electronic organs, and various new keyboard instruments conquer all.

The tuning of electronic organs is so much easier, and takes less time, and can be so much more precise, than that of the piano, that this factor alone may decide the question. So few people have been taught to tune pianos in recent decades that an extreme shortage of tuners has developed. Another lost art is succumbing to Progress. %$%$

Still Biting the Hands That Feed Them

It is hard enough to figure out why people commit suicide, but when a business does so, and does it slowly and fully deliberately, how can there be any rational explanation? Surely the usual dodge and evasive comment about suicides and self-torturers, that they are out of their minds when they do it, is appropriate enough here.

The "Southern California Rapid Transit District" is the latest successor to a long line of companies and quasi-governmental bodies that have been messing things up since the 1930's at least.

There is no rapid transit at all in Los Angeles. Just a few rush-hour express busses on the freeways, and while they make good time when actually travelling the freeways, traffic is choked to a virtual standstill between the downtown terminus of the bus line and the entrances to the freeways.

Near the end of 1969, an Exact Fare plan was instituted. This means you can't ride unless you have exact change to the penny--the drivers are forbidden to make change, and may give you a refund slip if they have any left, but they are too harassed with all the other more important things they have to do—especially the severe traffic jams they have to fight, which is no laughing matter.

This plan was instituted to prevent robbers from holding up bus drivers at gunpoint--but all it does is transfer the violence from the drivers to the passengers, who now are easy marks for any pick-pocket as well as armed robbers.

You can buy a Monthly Pass, but this only makes sense if you are a five-day-a-week commuter, and if you can afford the pass you probably could afford to drive a car.

You can buy tokens and tickets, at special offices which sell them, but there is no discount, only the convenience of ordering them by mail if you have enough money in the bank to write checks.

Everybody is up in arms about

(Continued on next Page)

STILL BITING THE HANDS THAT FEED THEM!

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the famous, rich brown, full-bodied, uniquely-flavored Los Angeles Smog, but what do you suppose the Pacific Electric Railway, the Los Angeles Transit Lines, the Metropolitan Coach Lines, the Los Angeles Motor Coach Company, the Los Angeles Railway, the Metropolitan Transit Authority, and now the Southern California Rapid Transit District, --not to mention dozens of municipal bus lines of smaller communities in the Los Angeles area, and various privately-owned lines, have done about the smog?

Why, of course, the most insane, thoughtless, improvident, stupid, nasty thing they could ever have done: take off all the streetcars, which was done several years ago, when this had been one of the largest electric railway and trolley--bus systems in the world! Los Angeles used to have a nine-tenths--mile subway and a huge downtown Subway Terminal, serving Hollywood and Glendale among other places.

That was closed down and converted into a Civil Defense air-raid and fallout shelter, together with Government offices.

Much noise was made in the newspapers and mass media about a proposition for a rapid transit system submitted to the voters a while ago. It was resoundingly defeated, and should have been, for it would only have served the wealthy people in their exclusive districts, while it did not go to the parts of town where poor people need public transportation most urgently, and besides that the fares would have been several times too high for them--they would not have been able to ride it if it did traverse their communities.

Those of you who live or have lived in such cities as New York, Chicago, San Francisco, Portland, Seattle, Kansas City, or several dozen other cities, may not understand our intense indignation about the Exact Fare scheme mentioned on the preceding page--such Exact Fare plans are working well in some of those cities, so what's all the fuss about? you want to know. It can be explained in just one word: Zones.

Unlike Manhattan or San Francisco or other closely-built-up cities, Los Angeles is spread out over immense distances. This is further complicated by hills. So a large percentage of Los Angeles residents never see the downtown from one end of the year to the other. They travel around the periphery of the Los Angeles County, often passing through several cities on their way. This means that no bus system could afford to charge one fare for distances up to 40 miles or more.

Hence the fare zones. They are changed every so often. The zone map is so complicated that nobody understands it. Fare is 30¢ to get on the bus at all. 5¢ more if you want a transfer. 8¢ more for each additional zone. Can you see how intolerable it gets when you have to ride through four or five Zones? And calculate beforehand how much small change you must carry? Even if you have a one- or two-zone pass and have to go to the third or fourth zone, out come the pennies.

The streets are dangerous for a person alone at night, and the waits for a transfer are long. So anyone in Los Angeles without a car, such as your editor, is virtually locked up in a small neighborhood.

So many beatings and murders and robberies occur here that the papers suppress them--the radio stations are somewhat more honest about it. As the victim of a beating, this is first-hand authentic information.

All the news media censor out and suppress ruthlessly any references to the incredibly worsening transit situation here. Why should they mention it, when the reporters and printers and broadcasters and executives never have to ride public transportation--they couldn't get to and from their jobs if they did.

If it were not for the few people who have provided us with a ride now and then, to whom we are eternally grateful, the picture would be one of total despair.

Within the time we have lived in this area, fares have quadrupled and even quintupled in some cases!! And the service gets worse and worse while the bus executives work as hard as they can to get rid of the few remaining passengers. FOR SHAME!