

II

THE MUSICAL QUALITY IN POETRY

1. THE TRIPARTITE NATURE OF VERSE

IN the analysis of poetry we shall make a division of the æsthetic factors into those pertaining to significance, musical quality, and metre.

The significance of a poem is to be found in its "poetic ideas," which must be expressed in accordance with Hemsterhuis's general dictum of the "greatest number of ideas in the shortest space of time." In other words the poet must begin with a poetic vision, and then by the use of poetic license, effective figures of speech, and onomatopoeic devices obtain an adequate embodiment of this vision in terse form; that is, in a form much shorter than would be necessary for an equally adequate expression in the language of prose.

One can find frequent appreciations of this first factor in poetry. The poet Shelley when he defined poetry as "the expression of the imagination" was alluding to the primacy of the poetic idea. The wellknown important rôle of poetic freedom as an essential element in expression is indicated by Pope as follows:

Thus Pegasus a nearer way to take,
May boldly deviate from the common track.

The terseness of poetry is stressed by Voltaire: "Poetry says more and in fewer words than prose."

The Musical Quality in Poetry 217

This factor of significance is evidently essentially connotative in its nature and beyond any possibility of formal analysis. It is perhaps the most important single element in poetry, and yet poetry without musical quality and metre is not properly poetry at all.

The other two factors of musical quality and metre are much more formal in their nature. It is because of these factors, which correspond to those of harmony and rhythm in music, that Fuller wrote "Poetry is music in words, and music is poetry in sound."

We shall say nothing of metre in what follows except to mention its similarity to rhythm in music. This similarity has been considered by Lanier in his *Science of Verse*, who goes so far as to use musical notation in order to specify metre. It is to be expected that metre in poetry will be susceptible of mathematical analysis in regard to æsthetic effect, just as is rhythm in music.

As far as metre is concerned, the poet must first select an appropriate and sufficiently pliable metric form; and then in the inevitable deviations from its rigid execution be guided by a delicate sensibility of their effect upon the ear.

The remaining factor of musical quality, to which we devote our attention, is in certain respects the most characteristic one. Thus Butler wrote:

For rhyme the rudder is of verses
With which, like ships, they steer their courses,

and Shelley lays a similar emphasis: "The language of the poets has ever affected a sort of uniform and harmonious recurrence of sound, without which it were not poetry and which is scarcely less indispensable to the communication of its influence than the words themselves without reference to their peculiar order." It is here that the ingenuity of the poet

218 Mathematical Theory of Aesthetics

is much more exercised than in following some more or less arbitrary metric form.

2. THE MUSICAL QUALITY IN POETRY

It must be borne in mind that the notion of musical quality, as separable from significance and metre in a poem, is only approximately tenable. In such a line as the following of Tennyson's:

The league-long roller thundering on the reef,

there is expressed an imaginative theme for the eye and ear in onomatopoeic language of the utmost terseness, having appropriate metric structure and unusual musical quality. This line is, however, to be looked upon as produced by the intimate union of these factors, and so as being much more a mere aggregation of them all.

Nevertheless it is certain that the musical factor is to a large extent appreciable by itself, so that two poems can be intuitively compared, in regard to their musical quality, almost regardless of their significance or metric form.

3. RHYME

The first and most obvious part of the musical factor in poetry is rhyme. Here, in Western poetry, one group of sounds is compared with another in the following manner. The initial (elementary or complex) consonantal sound of the first group corresponds to a distinct initial consonantal sound in the second group; the remaining sounds of the two groups are identical. It is required furthermore that the two groups contain one accented vowel sound having the same relative position in the two groups, and that these groups terminate with a word. The following are simple instances of such rhyming groups:

220 Mathematical Theory of Aesthetics

two lines from "The Bells," there is alliterative occurrence of the sound $s = z$.

A more nearly excessive use of alliteration and assonance occurs in the following interesting illustrative experimental stanza given by Poe in his essay "The Rationale of Verse":

Virginal Lilian, rigidly, humbly dutiful;
Saintlily, lowlily,
Thrillingly, holily,
Beautiful!

Here the consonant sound of l appears no less than sixteen times in the thirty syllables while the short vowel sound i occurs thirteen times. Observe also the five times recurring repeated syllable, *lili*.

A fundamental flaw in this stanza is of course the appearance in it of two non-existent adverbs, "saintlily" and "lowlily."

Alliteration, like assonance, is analogous to the element of repetition in melody.

6. THE MUSICAL VOWEL SOUNDS

In general the vowel sounds are smoother than the consonantal sounds, and, among the vowel sounds, there are certain ones which are especially musical in quality, notably the a as in *art*, the u as in *tuneful*, *beauty*, and the o as in *ode*. When these appear sufficiently frequently, they impart their soft musical character to verse.

The mathematician Sylvester in his *Laws of Verse*, to which we have already referred, has a footnote of interest in this regard. "I cannot resist the temptation of quoting here from a daily morning paper the following unconsciously chromatic passage . . . : 'The last portion of the shadow of the earth has been passed through by the moon which then again sailed in its full orb of glory through the dark blue

depth.'” Besides possessing pleasant alliterative and assonantal elements, this sentence contains nine musical vowels as follows: *last*, *passed*, *through*, *moon*, *full*, *glory*, *through*, *dark*, *blue*.

The æsthetic element introduced by these musical vowels in poetry may be compared with that due to the primary chords in melody.

There are doubtless certain special instances where the play of vowels and consonants produces a kind of musical tune in a poem, analogous to melody. Lanier (*loc. cit.*) says in this connection: “Tune is . . . quite as essential a constituent of verse as of music, and the disposition to believe otherwise is due only to the complete unconsciousness with which we come to use these tunes in all our daily intercourse by words.”

However, it would be very difficult to disengage this element in precise form, and it is not certain how far its rôle is really independent of that of the musical sounds, alliteration and assonance, already taken account of. For these reasons we do not attempt to deal separately with this somewhat obscure element of “tune” in a poem.

7. “ANASTOMOSIS”

Another æsthetic factor which is agreeable is that which results from the fact that a poem is easily spoken. In general this is brought about when the consonantal sounds are simple rather than complex and not much more numerous than the more easily pronounced vowel sounds. Sylvester used the term “anastomosis” to express this desirable quality (*loc. cit.*): “Anastomosis regards the junction of words, the laying of them duly alongside of one another (like drainage pipes set end to end, or the capillary terminations of the veins and arteries) so as to provide for

222 Mathematical Theory of Aesthetics

the easy transmission and flow of the breath . . . from one into the other.”

From our point of view this factor is not a unitary one, but needs to be split up into two others. On the one hand the complex consonantal sounds increase the “complexity” of the poem, which, in accordance with our theory, is correlated with the effort required in speaking it. Such complexity is heightened when a word ends with a consonantal sound and the following word begins with a sufficiently different consonantal sound. Hence such sequences are to be avoided as far as possible.

On the other hand, quite regardless of this factor of complexity, an excess of consonantal sounds is felt to be decidedly harsh and disagreeable. For example in the catch:

Midst thickest mists and stiffest frosts
With strongest fists and stoutest boasts
He thrusts his fists against the posts
And still insists he sees the ghosts.

there are approximately twenty-four consonantal sounds as against only eight vowel sounds in the first line, and a similar relationship holds in the other three lines. Here we have serious consonantal excess, a negative æsthetic factor.

Thus, from our point of view, “anastomosis” is secured by avoidance of consonantal excess and by the diminution of “complexity” as far as possible.

8. POE'S CONCEPT OF VERSE

We have now alluded to the principal elements of order involved in the musical quality of verse.

While there exists, so far as I have discovered, no earlier formulation of any “æsthetic measure” for this factor, nevertheless both Poe and Sylvester come within striking

The Musical Quality in Poetry 223

distance of an analysis of musical quality and metre in verse. The following quotations from Poe (*loc. cit.*) indicate sufficiently his point of view:

Verse originates in the human enjoyment of equality, fitness. To this enjoyment, also, all the moods of verse—rhythm, metre, stanza, rhyme, alliteration, the *refrain*, and other analogous effects—are to be referred.

The perception of pleasure in the equality of *sounds* is the principle of *Music*.

Anyone fond of mental experiment may satisfy himself, by trial, that, in listening to the lines he does actually (although with a seeming unconsciousness, on account of the rapid evolution of sensation), recognize and instantly appreciate (more or less intensely as his ear is cultivated) each and all of the equalizations detailed. The pleasure received, or receivable, has very much such progressive increase, and in very nearly such mathematical relations, as those which I have suggested in the case of the crystal.

Evidently in Poe's statements there is an assertion of the quantitative, additive character of the æsthetic pleasure produced, which corresponds closely with our concept of the order, *O*.

The notion of the complexity, *C*, does not enter explicitly in his analysis, but doubtless in the background of his ideas lies the implicit requirement of a large *density* of such order relations, or relations of "equality" as Poe termed them.

By equality, Poe had in mind not only identity in sound but also metric equality, so that, in effect, he proposed to deal with both mathematical factors of metre and musical quality. He refers nowhere to the non-mathematical factor of significance, although it is of course implicit in the background of his ideas. It is interesting that, precisely in respect of significance, Poe fails to be of the first rank among poets.

9. SYLVESTER'S CONCEPT OF VERSE

There is no doubt that Sylvester's concept of verse was much influenced by that of Poe. However, Sylvester went

224 Mathematical Theory of Aesthetics

further than Poe in approaching the point of view demanded by our mathematical theory, as the following wordy quotations show (*loc. cit.*):

In poetry we have sound, thought and words . . . ; accordingly the subject falls naturally into three great divisions, the cogitative, the expressional, and the technical to which we may give the respective names of Pneumatic, Linguistic and Rhythmic. It is only with Rhythm that I profess to deal. This again branches off into three principal branches—Metric, Chromatic and Synectic.

I touch very briefly on this branch of Metric accepting, in regard to it, the doctrine of Edgar Poe . . .

Metric is concerned with the discontinuous, Synectic with the continuous, aspect of the Art. Between the two lies Chromatic, which comprises the study of the qualities, affinities and colorific properties of sound. Into this part of the subject, except so far as occasionally glancing at its existence and referring to its effects, I do not profess to enter. My chief business is with Synectic.

This, also, on a slight examination, will be found to run into three channels *Anastomosis*, *Symptosis*, and between them the main flood of *Phonetic Syzygy*.

Evidently Sylvester's "Pneumatic" and "Linguistic" fall under what we have termed the significance (with appropriate brief expression), while his "Rhythmic" embraces both musical quality and metre. Furthermore he is concerned with musical quality rather than metre.

His last statement is the important one. As we have observed, his principle of anastomosis corresponds roughly to the requirement of as little complexity C , as possible. On the other hand his principle of symptosis "deals with rhymes, assonances (including alliterations so-called and clashes (this last comprising as well agreeable reiterations, or congruences, as unpleasant ones, i. e., jangles or jars)." It involves then the same elements of order as classified above. Consequently symptosis is more or less the counterpart of our order O .

Thus his "Phonetic Syzygy"—the effective combination

of "Anastomosis" and "Symptosis"—corresponds in a qualitative sense to our æsthetic measure of musical quality.

It does not appear that Sylvester believed the æsthetic effect produced to be quantitatively measurable as Poe had believed it to be.

10. ON PHONETIC ANALYSIS

As a first step towards the formulation of an æsthetic measure of musical quality in poetry, it is necessary to introduce certain agreements, as simple as possible, concerning phonetic analysis.

We shall recognize only the following *vowel* sounds as distinct:

aid, add, all, art; eve, ell; isle, ill; ode, or; use, lune, full, lull, urn; oil; out.

All vowel sounds, distinct from these, are to be assigned to the nearest one of these sounds.

The sounds of *a* as in *art*, *u* as in *tuneful*, *beauty*, *o* as in *ode*, will be called musical because of their agreeable quality, similar to that of a pure musical note.

The elementary *consonantal* sounds are taken to be the following:

b, d, f, g, h, j, k, l, m, n, n(g), p, r, s, t(h), w(h), y, z.

The ordinary *g* sound is not regarded as present in *ng* although *n* is present. Likewise the aspirate *h* is not regarded as present in *th* and *wh* although *t* and *w* are present.

All other composite consonant sounds are regarded as made in the manner indicated by the usual spelling.

The phonetic justification of these simple conventions is obvious. Vowel and consonantal sounds not used in the English language need not be considered of course, since we are dealing with English poetry only.

226 Mathematical Theory of Aesthetics

11. THE COMPLEXITY C

The complexity C of any part of a poem—as, for instance, of a single line—is simply the total number of elementary sounds therein, increased by the number of word-junctures involving two adjacent consonantal sounds of the same line which do not admit of liaison.

The following pairs of distinct consonantal sounds will be taken to admit of *liaison*: $b, p; d, t; f, v; g, k; m, n; s, z$. Likewise if the second sound is an aspirate h , liaison will be admitted.

The justification for the rule is self-evident, for we may with very fair approximation to the facts consider each vowel sound and elementary consonantal sound as being equally difficult to pronounce. Furthermore adjacent consonantal sounds between different words are nearly as difficult to pronounce as if there were a vowel sound between them. The rule takes account of all these facts in a simple way.

12. THE ELEMENT $2r$ OF RHYME

The number of sound groups in the line or part of the poem under consideration which rhyme with at least (and in general only) one sound group earlier in the same line or in an earlier line will be designated by r . The corresponding element of rhyme is then taken to be $2r$. It is seen then that the index 2 is assigned to the tone of feeling due to a single rhyme. Later we shall assign an index of 1 to the single alliteration or assonance. The higher rating of the rhyme is justified by the greater intensity of the tone of feeling which each rhyme induces.

The reason for counting each rhyming group only once, even though it rhymes with more than one earlier group, is

that each rhyming group is in general set against one particular contrasting earlier group.

By general consent certain slight liberties are allowed in rhyming. For instance the *u* sounds as in *use* and *lune*, are allowed to replace one another. We will not undertake to enumerate these wellknown exceptions.

The evaluation of the element *r* is immediate in all cases. For example in the case of Poe's stanza there are the two following rhyming groups:

lowlily, *holily*; *beautiful*, *dutiful*.

Thus *r* is 2 and the element $2r$ of rhyme is 4 in this case.

13. THE ELEMENT *aa* OF ALLITERATION AND ASSONANCE

In dealing with the element of alliteration and assonance, it is necessary first to specify limits within which the repetition of a consonant or vowel sound is pleasantly felt, and then to decide in how far repetitions may accumulate before there is alliterative or assonantal excess.

The short nondescript vowel sound as in *the*, *attention*, which may be considered to be a short form of *u* as in *lull*, will not be regarded as assonantal under any circumstances.

In order to give an empirical definition of the element *aa* of alliteration and assonance, we shall introduce certain technical terms.

A *leading sound* of a line will be defined as one which either is part of an accented syllable, or occurs as the initial sound of a line, or is part of a rhyming group other than the initial consonantal sound.

Such leading sounds are precisely those which most impress the ear.

A sound, *a*, in a certain position will be said to be *directly connected* with the same sound or sounds in other positions as follows: (a) the same sound is found again in the same

228 Mathematical Theory of Aesthetics

word as *a* or in an adjoining word; (b) the same sound occurs as a leading sound earlier in the line than *a*, or in the last half of the preceding line provided *a* occurs in the first half of its line; (c) *a* follows a pair of the same sounds earlier in the line, which are in the same word or in adjoining words; (d) the same sound occurs as a rhymed leading sound or as a leading sound in the same relative position as *a*, either in the preceding line or in an earlier line rhymed with the line containing *a*; (e) the same sound occurs in an identical syllable, earlier in the line than *a* or in the last half of the preceding line provided *a* occurs in the first half of its line.

If there are an odd number of feet in a line, the middle foot will be considered to be part of both the first and second halves of the line in applying these definitions; moreover if a line contains only two feet we shall include both feet in either half of the line, by special convention.

When the same sound is repeated under these conditions the repetition produces an effect of alliteration or assonance which is felt agreeably.

With these definitions in mind we shall define the element *aa* of alliteration and assonance in the line or group of lines under consideration as the number of sounds directly connected with others in the same or preceding lines, and not directly connected with more than two leading sounds or more than four sounds in all.

The reason for the restriction imposed lies in the obvious fact that beyond a certain point alliterative or assonantal play upon a particular sound is felt to be monotonous and even disagreeable. This is in accordance with the usual effect of undue repetition. The precise limits assigned are of course a matter of somewhat arbitrary choice.

In illustration of this rule let us consider Tennyson's line

The Musical Quality in Poetry 229

already quoted in section 2. The leading sounds are evidently the sounds italicized below where the figures 1, 2, 3, 4, 5 are set respectively above the sounds *t*, *l*, *e*, *n*, *r*; these are the only ones to enter in *aa*:

¹ ^{2 3} ^{2 4} ^{5 2} ^{5 1} ⁴ ^{5 4} ^{4 1} ^{5 3}
The league-long roller thundering on the reef

Here the second and third sounds *t* count since they are directly connected with the earlier positions; all three sounds *l* are directly connected with one another and are counted; the second sound *e* (long) counts since it is directly connected with the first; the last three sounds *n* count, being directly connected with one another, but the first does not count; the three sounds *r* count since the first two are directly connected, and the third is directly connected with the first two. Thus *aa* is 11 for this line.

A practical method of evaluation of the element *aa* is to start with the first sound to occur, and put a dot over all its positions which are counted in *aa*, then to do the same with the second sound, and thus continue to the end. The total number of dots gives the element *aa* required, at least unless the limit of desirable alliteration and assonance is reached.

An example of a case in which the limit of desirable alliteration and assonance is exceeded is furnished by Poe's stanza. In such rare complicated cases it is convenient to put small circles around the sounds such as *l* and *i* which are not to be counted in *aa*, but otherwise to proceed as before. Thus we obtain

Virginal Lillian rigidly, humbly dutiful;
 Saintlily, lowlily,
 Thrillingly, holily,
 Beautiful!

230 Mathematical Theory of Aesthetics

It is to be noted that, in accordance with our rule, the rhyming sounds in "holily" and "beautiful," other than the initial *h* and *b*, are to be counted in *aa*. Furthermore the final *y* occurring five times is interpreted as a long *e* and not as a short *i* sound. We find then that *aa* is 31 in this case.

14. THE ELEMENT *2ae* OF ALLITERATIVE AND ASSONANTAL EXCESS

According to the definition of the element *aa* of alliteration and assonance, repetition of a sound beyond a certain point does not have further favorable effect. We have still, however, to make allowance for the fact that the alliteration and assonance may become positively unpleasant under certain circumstances.

These circumstances are of the following three types: (a) the sound in question is a leading sound directly connected with too many earlier leading sounds; (b) the sound forms part of successive identical syllables not in the same word; (c) the sound in question is one of a uniform series of regularly recurring repetitions.

The effect produced by the immediate repetition of syllables as in (b) is cacophonous. It was to avoid this fault that Collins changed the second line of his "Ode to Evening" beginning:

If aught of oaten stop, or pastoral song
May hope, *O pensive Eve*, to sooth thine ear

to

May hope, chaste Eve, to soothe thy modest ear.¹

The element of cacophony may be compared to that of false cadence in harmony: more precisely, the repetition of a syllable ordinarily occurs in the agreeable repetition of a word or of a group of words, or else in a rhyme; conse-

¹ See J. L. Lowe's "Convention and Revolt in Poetry." Boston, 1919.

quently when such repetition is not of one of these types, there is an unpleasant feeling of frustration.

Likewise the effect produced by the same sound repeated several times at uniform intervals is artificial and unpleasant, whether these sounds occur in successive words, feet, lines, or stanzas.

Our definition of ae will then be the number of leading sounds directly connected with more than two earlier leading sounds, and of sounds belonging to a syllable immediately following the same syllable, but not in the same word, or to a uniform series of the same sounds containing at least three earlier sounds.

The negative element of alliterative and assonantal excess will then be defined to be $2ae$. In other words, an index -2 will be assigned to the corresponding sounds.

It need hardly be said that there will rarely be found excessive alliteration or assonance of this sort in satisfactory poetry, and that when it is present, the ear will note the effect at once. Thus ae is 1 in the case of Poe's stanza because the repeated sound ly occurs at the end of four successive words.

On the other hand, in the catch of section 7 the first line contains the sound s six times as a leading sound and the sound t five times as a leading sound, all of these directly connected. Hence, according to definition, three of the sounds s and two of the sounds t count in ae , so that the element $2ae$ is 10 in this line alone.

15. THE ELEMENT $2m$ OF MUSICAL VOWELS

We shall define the element of musical vowels as $2m$ where m is the number of musical vowels (a as in *art*, u as in *tuneful*, *beauty*, and o as in *ode*) increased by the number of vowels o as in *or* and a as in *awe* which are directly con-

232 Mathematical Theory of Aesthetics

nected with an earlier long musical vowel *o* and *a* respectively. The limitation will be imposed, however, that such musical vowels directly connected with more than two other earlier vowels shall not be counted in *m*.

The limitation is introduced because repetition of musical vowels is of no interest beyond a certain point.

The reason for counting the short *o* after the long *o* is merely that when one tries to pronounce the *o* in such a word as "or" so that it is long, it tends to take the short form. Thus the long and short forms are closely connected, and if the long musical form of *o* precedes the short form and is not too far from it, the short *o* takes on the same musical quality also.

Furthermore, the closeness of the two sounds of *a* justifies the similar rule for the sound *a*.

Such euphonious lines as

Little boy blue, come blow your horn,

and

Come into the garden, Maud,

with $2m = 8$ and $2m = 6$ respectively show the effectiveness of the musical vowels when used in such a manner.

16. THE ELEMENT $2ce$ OF CONSONANTAL EXCESS

In case there are in all more than two elementary consonantal sounds for each vowel sound in any line, an appreciably harsh effect is produced. For this reason we shall define the consonantal excess as $2ce$ where ce is the excess of the consonant sounds over twice the number of vowel sounds in each line. In illustration we consider the first line of the catch of section 7. Here there are eight vowel sounds and twenty-four consonantal sounds. Hence the excess $2ce$ in this line alone is 16.

The Musical Quality in Poetry 233

The element $2ae$ enters of course as a negative element.

17. THE ÆSTHETIC FORMULA

The complete æsthetic formula for the musical quality in poetry is taken as follows

$$M = \frac{O}{C} = \frac{aa + 2r + 2m - 2ae - 2ce}{C}$$

Here all the elements which enter have been explicitly defined in the preceding sections.

In order to evaluate M systematically, the following method is convenient:

(1) Determine C by direct phonetic analysis of each line. The successive numerals 1, 2, 3, ... may be placed under the successive sounds of the line and under the junctures not capable of *liaison*.

(2) Consider the successive sounds in their order of appearance and put a dot over all those which are alliterative or assonantal, and then place a circle around those dots (if any) for which the sound does not count in aa .

(3) Place two dots over the accented vowel sounds rhyming with the same sound in the same line or in an earlier line.

(4) Place two dots over each musical sound and a circle around those dots (if any) for which the sound does not count in $2m$.

(5) The total number of dots not enclosed by circles then gives $aa + 2r + 2m$.

(6) Determine the sum $2ae + 2ce$ which is in general 0 in any satisfactory poem.

(7) Subtract this sum from that specified in (5), obtaining O .

(8) The æsthetic measure M is then O/C .

In the tabulation of these items it is convenient to put

D	o	w	n	t	o	a	s	u	n	l	e	s	s	e	a	11
1	2	3	4	5	6	7	8	9	10	11	12	13	14			14

These computations indicate that the number of elements of order ($O = 80$) is not much less than the number of sounds ($C = 101$), their ratio giving an æsthetic measure of .79 for the stanza. From this point of view the first and fourth lines are the most musical.

Lamb made a very trenchant estimate of this remarkable poem in referring to it as “a vision Kubla Khan which said vision he [Coleridge] repeats so enchantingly that it irradiates and brings heavenly bowers into my parlor while he sings or says it; but there is one reservation, ‘Never tell thy dreams’ and I am almost afraid Kubla Khan is an owl that won’t bear daylight. I fear lest it should be discovered by the lantern of topography and clear reductibility to letters no better than nonsense or no sense.”

In other words, the significance of Coleridge’s poem is elusive and slight, although the element of musical sound is almost magical. The same criticism would apply to much of Poe’s poetical work, of course.

19. AN EXPERIMENTAL POEM

In his essay on “The Philosophy of Composition” of 1846, Poe analyzed step by step his construction of his poem “The Raven” and claimed that his theory had been used as a conscious and effective tool in its composition.

What is remarkable here is not that Poe had a theory. Almost every creative artist has a theory or point of view which, for him, sums up the inner secret of his success. Rather it is the fact that Poe expressed his theory in mechanical terms.

As of possible interest I shall give an account of a some-

236 Mathematical Theory of Aesthetics

what similar experiment made by myself on the basis of the theory described above. This experiment was undertaken in order to clarify my own ideas about the nature of poetic composition and to subject them to a test. The reader will have to judge for himself as to the success of the experiment.

According to the theory it was first of all necessary to start from an idea having some poetic quality. Here I chose an idea concerning the general nature of knowledge which I had expressed in prose as follows:

“We may compare if we will, our bits of knowledge to luminous threads which we wind into a compact, luminescent ball. By skilful arrangement of the threads there begins to appear in the center of this ball a bright vision of concepts and laws. If now we add further irrelevant threads, the vision is obscured; and if we unwind the threads in an effort to approach the vision more intimately it becomes more and more faint, and finally disappears.”¹

My first attempts to incorporate this idea in poetical form were very unsuccessful. The chief reason for the lack of initial success seems to me now to lie in the fact that the expression of the idea was not sufficiently *terse*. The requirement of terseness is of course fundamental.

Then one day came without apparent effort the following:

Vision

Wind and wind the wisps of fire,
Bits of knowledge, heart's desire.
Soon within the central ball
Fiery vision will enthrall.

Wind too long or strip the sphere,
See the vision disappear!

¹ *Science and Spiritual Perspective*, Century Magazine, 1929.

The Musical Quality in Poetry 237

The æsthetic measure of this short poem according to the criterion above is .59. Comparison with the ratings of an arbitrarily selected list of poetic lines (section 19) indicates that these lines may be considered as of fair musical quality according to our theory. In this case the poetical form of expression, although more terse, falls short of the prose form in exactitude, but has perhaps the advantage of inducing more emotional interest.

In the writing of these six lines there was certainly no conscious use of the formula. Nevertheless I believe I could not have done nearly so well, without conscious reflection concerning the æsthetic factors in musical quality, taken account of by the formula.

20. FURTHER EXAMPLES

For the purpose of testing the theory a number of characteristic opening lines of varying musical quality were selected and then arranged by others in the order of their æsthetic preference, as far as musical quality was concerned. The arrangement thus obtained was found to be substantially in accord with that indicated by the theory as tabulated below.

$$M = .78$$

In Xanadu did Kubla Khan
A stately pleasure dome decree
Where Alf, the sacred river, ran
Through caverns measureless to man
Down to a sunless sea.

From Coleridge's *Kubla Khan*

$$M = .70$$

Little boy blue, come blow your horn
The sheep's in the meadow, the cow's
in the corn.

From a nursery rhyme

238 Mathematical Theory of Aesthetics

$M = .69$

Take, oh, take those lips away
That so sweetly were foresworn
And those eyes, the break of day,
Lights that do mislead the morn.
From Shakespeare's song
Take, Oh Take Those Lips Away

$M = .66$

Come into the garden, Maud,
For the black bat, night, has flown,
Come into the garden, Maud,
I am here by the gate alone;
And the woodbine skies are wafted abroad,
And the musk of the roses blown.
From Tennyson's *Maud*

$M = .64$

Tell me not in mournful numbers
Life is but an empty dream!—
For the soul is dead that slumbers
And things are not what they seem.
From Longfellow's *A Psalm of Life*

$M = .63$

Hear the sledges with the bells,
Silver bells!
What a world of merriment their melody foretells!
From Poe's *The Bells*

$M = .55$

Bright Star, would I were steadfast as thou art—
From Keat's *Last Sonnet*

$M = .49$

Onward, Christian soldiers,
Marching as to war,
With the cross of Jesus
Going on before!
From Baring-Gould's *Onward, Christian Soldiers*

$M = .41$

The white mares of the moon rush along the sky
Beating their hoofs upon the glass heavens;
The white mares of the moon are all standing on their hind legs
Pawing at the green porcelain doors of the remote heavens.
From Amy Lowell's *Night Clouds*

$M = .36$

He never had much to give,
Subscription lists knew not his name,
He was one of the many who live,
Unrecorded in charity's fame.
From E. A. Guest's *Contribution*

It may be remarked that instances of consonantal excess appear in several of these cases, namely in the fourth line of Longfellow's *Psalm of Life* ($ae = 1$), in the first line of Keat's *Last Sonnet* ($ae = 2$), in the first line of Baring-Gould's *Onward, Christian Soldiers* ($ae = 5$), in the long third line of Amy Lowell's *Night Clouds* ($ae = 3$) and in the second line of Guest's *Contribution* ($ae = 7$).

It is well to bear in mind the precise significance claimed for these and similar results:

(1) The æsthetic measure M defined above is applicable primarily to the great body of English poetry of conventional type; the definition made can doubtless be considerably improved on the basis of further experiment.

(2) Only the musical quality of this kind of poetry is so measured. Every good poet will find it desirable to sacrifice this musical quality occasionally in order to produce some subtle musical effect or to increase expressiveness.

(3) In so far as this measure M is applied to more recent writers (such as Amy Lowell, for instance), it serves only as an indication of the presence or absence of the musical quality of this conventional type.

240 Mathematical Theory of Aesthetics

21. SONOROUS PROSE

It is obviously possible to measure the musical quality of sonorous prose by the same methods. For this purpose it is only necessary to write the prose as nearly as possible in the form of verse and then to apply the same rules. For instance the following sentence from Sir Thomas Browne's *Hydriotaphia* is so written:

Circles and right lines limit and close all bodies
And the mortal right-lined circle
Must conclude and close up all.

As written, the sentence has an æsthetic measure M of 57 and so must be regarded as on a level with most poetry in degree of musical quality.

22. POETRY IN OTHER LANGUAGES

As far as I have been able to make out, the aim of poetry is essentially the same whatever the language or period. It is true that rhyme may assume different forms or may be absent as in blank verse. But the fundamental aim is always to achieve the terse imaginative expression of a poetic idea in metric form by use of language of unusual musical quality.

23. THE RÔLE OF MUSICAL QUALITY

In order to avoid misunderstanding I would like to emphasize once more that musical quality is only one of the essential elements in poetry: and that even this quality cannot be measured in its more delicate *nuances* by any mechanical method, such as that given above.

Nevertheless, it seems to me that some such objective method of evaluation can play a useful if modest rôle, even

The Musical Quality in Poetry 241

to the poet himself, somewhat as the rules of perspective drawing are useful to the painter.

Paul Valéry, the French poet, has expressed the extraordinary difficulty of poetic achievement: "One feels clearly in the presence of a beautiful poem of some length how slight is the chance that a man could have improvised without revision, without other fatigue than that of writing or of uttering what comes to his mind, an expression of thought, singularly certain, showing power in every line, harmonious throughout, and filled with ideas that are always felicitous, an expression that never fails to charm, in which there are no accidents, no marks of weakness or of lack of power, in which no vexatious incidents break the enchantment and destroy the poetic universe. . ."¹

Nevertheless in achieving this complex, difficult end, the poet *must* take cognizance of the essential formal factors of metre and musical quality which differentiate poetry from prose.

Of this necessity upon the poet, and of others, Valéry speaks as follows (*loc. cit.*): "Behold the poet at grips with this emotional and too mixed material [of language]; constrained to speculate concerning sound and sense in turn to achieve not only harmony, and musical phrasing, but also to satisfy a variety of intellectual conditions, logic, of grammar, the subject of the poem, figures and ornaments of all kinds, not to mention conventional rules. See what an effort is involved in the task of bringing to a successful end an expression of thought in which so many demands must all be miraculously satisfied!"

¹ *La Poésie*, Conferencia (1928).