

LOGIC AND MUSIC
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A

Thesis presented for

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by

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" The perfect musician is the man who practices his art on the foundation of a scientific mastery of theory."

ZARLINO

" If music is a way of thinking, logic should take note of it....."

FRANK HOWES

" Music depends not only on acoustics, but on logic....."

ARNOLD SCHOENBERG

LOGIC AND MUSIC
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- CHAPTER ONE -

INTRODUCTION

Throughout the whole realm of physical and rational existence, integration is at once the antithesis and the complement of specialisation. Fusion of like with like, occasions neither surprise nor defence; but join like with unlike, and immediately one is aware of trespass, hostility, and the disastrous consequences of forced analogy. States Dr. Martin Johnson (1), "Fact and fancy, exercise of the reason and of the imagination, training towards the logical and the visionary, surely these are pairs implying not merely antithesis, but antagonism? "

(1) "Art and Scientific Thought" p.15.

Yet, significantly in the works of the early Oriental mystics, and in Plato, Spinoza and McTaggart, there are discernible attempts to reconcile the scientific with the imaginative, the logical with the mystical.

Is this mere indulgence in the piquancy of unfamiliar flavours? Does it create the stigma of dilettante blindness to responsibilities? Is there gain in relating like with unlike? How feasible is it to bring music into relation with those sciences and fields of knowledge that have man's soul, body and mind as their province of inquiry?

It is proper for worship to admit such a relation, for music as an art was nurtured within the Christian Church; and it is natural that the incantations of the old witch doctor should find sublimation in the recently formed Council for Music in Hospitals, which concerns itself with investigating the therapeutic value of music. Further, it is not inappropriate for Anthropology and Sociology to admit a relation with music, for man is a social animal, and music, in part, is a social activity.

But when the various branches of Philosophical thought are brought to bear on music, one may doubt the propriety of seeking relations, when one realises the lessening degree of kinship. Certainly Psychology and Aesthetics accept music within their sphere, but

Ethics? Logic? Politics? Metaphysics? Their subject matter and that of music would appear to be mutually exclusive, so that no relationship would seem possible - at least, on casual acquaintance. There are those, however, who have sought affinities, not thereby to cause re-orientation in these fields of Philosophy, but to enrich music, and the study of music.

What do we profit when Logic and Music are paired for examination? The logician, as logician, has no need of music, while the subject matter of logic would seem to be singularly unyielding of a focus on music. But, apparently, the musician, as musician, has need of logic, for the word 'logic' and its derivatives are of frequent occurrence in literature on music.

Certainly it is the case that these words are often used as in ordinary discourse i.e. in the sense of 'consistency', 'soundness' or 'reasonableness'; but they are used also in a context which leaves no doubt that a closer parallelism is intended. It is the assumption by some authors that there is a likeness between logic and music, and their assertion of musical counterparts to logical procedures, that have prompted this investigation, and that have led to a searching for particular contributions which logic may have for music, contributions which, if they can be found, will be unique in the sense that only logic can be responsible for them, and that

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music, alone, because of its nature, and in spite of its nature, can be capable of receiving benefit from them.

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- CHAPTER TWO -

PROBLEMS

Initial inquiries led to awareness of certain problems. They are stated here, with brief comment.

1. THE RELATION OF SCIENCE TO ART.

The Concise Oxford Dictionary defines Logic as the science of reasoning, proof, thinking or inference; and Music as the art of combining sounds with a view to beauty of form and expression of emotion. A science may be defined as systematised and formulated knowledge; an art as the practical application of any science (i). W.S. Jevons puts it this way (ii): A science teaches us to know, and an art to do. He adds: All the more perfect sciences lead to the creation of corresponding useful arts. The word 'useful' in this context need not concern us here, but the assertion that there is a relation between (some) science and (some) art may remind one

(i) Concise Oxford Dictionary.

(ii) "Elementary Lessons in Logic" p.7.

that logic has also been described as the art of reasoning, the art of thinking (Isaac Watts), the Science of sciences, and the Art of arts (Don Scotus - Thirteenth Century).

Thus at the outset, two questions arise:

- (1.) Is there a basic factor, common to both Science and Art, so that association of the two is not impracticable?
- (2.) Is logic a science or an art?

In answer to the first, Dr. Johnson suggests (1) that art and science are each attempts to communicate mental images through patterns, structures and forms, in the qualitative domain of feeling, and in the quantitative domain of measurement respectively.

An answer to the second is given by Jevons (11) - " Logic is a science in so far as it merely investigates the necessary principles and forms of thought..... it becomes an art when it is occupied in framing rules to assist persons in detecting false reasoning."

But, on reading that the Shorter English Dictionary includes in its definition of music, this clause - "the science of the laws or principles by which this art is

(1) "Art and Scientific Thought" p.16.

(11) "Elementary Lessons in Logic" p. 8.

regulated ", a third question arises:

(3.) Is music an art or a science?

In spite of strenuous assertion by some (i) that music is, and can be only, art, evidence can be cited in support of music being regarded as science - from the study of music in Ancient Greece, to that in Modern Germany where the term 'Musikwissenschaft' is used to denote the scientific study of music. The objection will be raised that the study of music is not the same as the music itself; and if further support is taken in the title of Sir John Hawkins' "The Science and Practice of the History of Music" (published in 1776), the objection will be that the history of music is not the whole of music..... More to the point, Guido Adler, writing in 1885, states (in "The Scope, Method and Object of Musical Science") that all people who have an art of music, also possess a science of music, undeveloped though it may be as a scientific system (ii). Finally, John Redfield - originally in 1926 - is persuasive that there is a science of music, and that the study of that science is important (iii).

That there are no logical grounds for not admitting music both as science and art may be shown (a) by logical

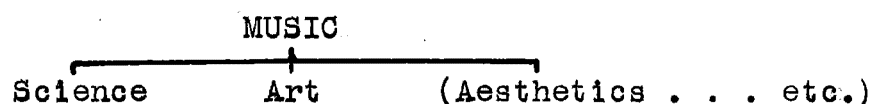
(i) for example, Sir Donald Tovey.

(ii) Quoted in the article on Musicology, Groves Dictionary of Music and Musicians. 5th.Edition.

(iii) "Music: A Science and an Art" p.303

division, and (b) by pointing out the distribution of the terms when the issue is recast as a series of Particular Propositions:

(a) LOGICAL DIVISION.



(b) DISTRIBUTION OF TERMS.

<u>Proposition</u>	<u>Subject</u>	<u>Predicate</u>
I. Some part of music is science.	Undistributed	Undistributed
(reference is not made to the whole of music, nor to the whole of science.)		
O. Some part of music is not science.	Undistributed	Distributed.
(reference is made to the whole of science being excluded from some music.)		

and similarly

I. Some part of music is art.

O. Some part of music is not art.

This question as to whether music is art or science, or partakes of both (and this latter is the case), is an attempt to convince those who would reject, from the start, any contact of logic with music on the grounds that science and art operate in different fields, (and

are incapable of blend), that if both logic and music admit of being an art and a science, each within themselves, it is not an improbability that each of them may admit a relation with an outside science and art.

Before leaving this problem, we may refer back to **the** question one on page 8 - is there a basic factor common to both science and art? In answer, we cited Dr. Johnson's suggestion in the affirmative: communication. And, ultimately, what governs communication? Mind, brain, intellect. In the words of W.S. Jevons: Whatever there is that is great in science or art, is the work of intellect (1). Here indeed is the basic factor in equating logic and music.

2. THE RELATION OF CONCEPTUAL TO NON-CONCEPTUAL THINKING.

Another objection that may be directed against this study is that the very nature of music constitutes too fundamental a difference to allow comparison with logic. The French music scholar, Leon Jean Combarieu (d. 1916) writes (11) --

"La musique est l'art de penser avec des sons, sans concepts."

(Music is the art of thinking in sounds without concepts.)

(1) "Elementary Lessons in Logic" p. 8.

(11) "Music, Its Laws and Evolution" p.7.

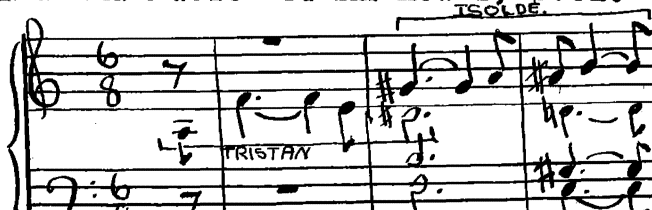
This non-conceptual thought offers the basic challenge in co-ordinating music and logic, for logic, in the words of the contemporary logician, Alfred Tarski (1), is the name of a discipline which analyses the meaning of the concepts common to all the sciences, and establishes the general laws governing the concepts.

It has been stated (ii) that the musician who, more than any other, has managed to think in sound with concepts, is Richard Wagner (1813 - 1883), and who, by means of the leitmotif, imports concepts into music. Not in itself a concept, but by the mind's powers of association, the equivalent of one, the leitmotif is the musical synonym of an extra-musical idea, with which songs and programme music are full.

Now, music may be classified either as programmatic, or as non-programmatic - for which the term 'absolute' or 'abstract' is used. Because of the directing power of a programme, it is proposed to reject consideration of music other than absolute, and thus there still exists the difficulty of a transition from logic to music. Analogy provides a way, and this way is examined in Chapter Four.

(1) "Introduction to Logic" preface p.xiii.

(ii) "Man, Mind and Music" Frank Howes, p.81. e.g. - Wagner's



3. EXTENSION OF THE TERM "MUSIC" AS USED IN THIS THESIS.

To the lay mind, the practical aspect of music may mean performance, and to some, performance may well mean the whole of music; but in this thesis there is intentional neglect of music in performance which is not equivalent to saying, neglect of music in practice. This may be shown by presenting the system drawn up in the first century A.D. by Aristides Quintilianus (1) where it will be noticed that the practical portion is subdivided:

SYSTEM OF QUINTILIANUS

I. Theoretical Portion:

A. Science

- (a) Arithmetic
- (b) Physics

B. Technique

- (a) Harmony
- (b) Rhythm
- (c) Metre

II. Practical Portion:

A. Composition

- (a) Melody
- (b) Rhythm
- (c) Metre

B. Execution

- (a) Instrumental
- (b) Vocal
- (c) Dramatic

(1) Grove's Dictionary, Article on Musicology.

Nowadays, the division of music into theory and practice is almost without meaning (i), and so, for this reason, we decline to explore the connections between theory and practice, and to state simply, that music in performance or execution, involving as it does, issues of psychology and aesthetics, lies outside the field of this present inquiry.

Thus, having rejected music with a programme, and music from the point of view of performance, we may now tabulate the subject matter of music pertinent for investigation, by quoting the plan of Guido Adler - which he presents under the title of "Musical Science" (ii) -

(i) Dr. H. S. Middleton, article "Music Studies" in the Proceedings of the Royal Musical Association, April 1945.

(ii) Grove's Dictionary, Article on Musicology. In passing, it may be noted that the English term 'Musicology' may be regarded as an example of the principle that all science may be viewed as applied Logic, expressed by the Greeks in calling the science of any subject, the logic of it.

MUSICAL SCIENCE (after Adler)

I. HISTORICAL SECTION: (History of Music)

- A. Musical Palaeography (Systems of Notations)
- B. Historical Basic Forms
- C. Laws (a) as they occur in the compositions of each epoch;
(b) as they are conceived and taught by the theorists of each period;
(c) as they appear in the practice of the arts.
- D. Musical Instruments

II. SYSTEMATIC SECTION: (Tabulation of the chief laws applicable to the various branches of music)

- A. Investigation and justification of these laws in
 - (a) Harmony
 - (b) Rhythm
 - (c) Melody
- B. Aesthetics and Psychology of music
 - (a) Comparison and estimation of value, and their relation to apperceptive subjects;
 - (b) Complex of questions either directly or indirectly connected with the foregoing.
- C. Musical Pedagogics
 - (a) The general teaching of music;
 - (b) The teaching of harmony;
 - (c) The teaching of counterpoint;
 - (d) The teaching of composition;
 - (e) The teaching of orchestration;
 - (f) Methods of teaching singing and instrumental playing.
- D. Musicology: Research and comparative studies in connection with folklore and ethnology.

The subject matter of Logic pertinent to this study will be derived from the contents with which an elementary text deals - for example, selected from Cohen and Nagel's "An Introduction to Logic and Scientific Method" these matters -

I. FORMAL LOGIC

- (a) Propositions and their relations
- (b) The Syllogism
- (c) Generalised or Mathematical Logic
- (d) Probable Inference

II. APPLIED LOGIC

- (a) Hypothesis and Scientific Method
- (b) Classification and Definition
- (c) Methods of Experimental Inquiry
- (d) Probability and Induction
- (e) Probable Inference in History
- (f) Logic and Critical Evaluation

Not necessarily will any or all of the above topics be pertinent.

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By reference to significant quotations concerning (I) Historical relations; and (II) Analogical relations, Chapters Three and Four aim at pointing to, and discussing similarities between Logic and Music.

- CHAPTER THREE -

SIMILARITIES - I.

Historical

- (a) "In general, the writers of the various periods reflect the philosophies of the ages they represent, whether scholastic, empiristic, rationalistic" (i)
- (b) "The Aristotelian Logic is as evident in the Medieval Latin treatises on music, as in the compositions of the great Parisian school, the Ars Antiqua of about 1200." (ii)

COMMENTS:

As studies, both Logic and Music have a common origin in philosophy. The root meaning of 'philosophy' is the loving pursuit of all skill, all knowledge, and all wisdom, and thus music as well as logic, found its own place in the scheme of things as testified in the works of Plato, Aristotle, Aristoxenus, Plutarch, Boethius and Cassiodorus amongst the Greeks and Romans, and Al-Farábí among the Persians.

-
- (i) "Introduction to Musicology" Glen Haydon, Introduction, page 7.
 - (ii) "Music, History and Ideals" Leichtentritt, Introduction, page 24.

The scholastic conception of music was scientific, rather than artistic, for in the words of Boethius, science is far superior to art as a mental achievement. The stand taken by Boethius was that of a speculative mathematician rather than that of a "real" musician; it was a view pre-occupied with the symbolism and speculation of numbers, rather than that of actual sounds and melodies. The numerical properties that formed the basis of all musical understanding were discernible only through 'ratio', not through the sense of hearing, and thus the analytical power of the mind is held to be of greater worth than mere aural perception. This, basically, was the outlook on music during the Middle Ages, until the advent of Ars Nova, about the beginning of the Fourteenth Century.

The dominant philosophical thought of the Scholastic period is Aristotelian, and so quotation (b) on the previous page - a particular example of the generalisation stated in quotation (a) - appears especially suggestive for inquiry, and ultimate affirmation or denial. Ideally, these conditions need fulfilling:

- (a) A knowledge of Aristotelian Logic, (Analytics); acquaintance with the classical Greek language;
- (b) A definition of the class "Medieval Latin treatises on music", with regard to dates, authors and works; access to these treatises; acquaintance with Latin;
- (c) Enumeration of the composers of the

Parisian school; classification of compositions; access to scores both in facsimile and in modern transcription; some opportunity for hearing the music interpreted in the light of present knowledge of the style and method of performance which existed in c.1200 A.D.

Here in New Zealand, it is possible to comply with those conditions in (a) but with some only in (b) and (c), the main reason being the inaccessibility of the manuscripts of authors and composers. Thus it is only from generalised sources that some idea of the subject matter of these treatises may be gained, and of their practical application in the Organa, Conducti and Motets of the period. The subject matter of the treatises includes Musica Ficta, Notation, Interval Relationship, Hocket, Canon - but it is the treatment of the Rhythmic Modes by the composers and theorists (whose presentation of which is described by Dom Anselm Hughes as "clear and logical" (!)), which suggests the point of contact with Aristotelian Logic.

Pythagorus re-appears as one of the principal figures in the "musical mythology" (1) of the Middle Ages. Stemming from the Neo-Pythagorean number-symbolism of Nichomacus, attempts to provide cohesion in measured music were based on the use of the six rhythmic modes, they themselves being founded on the feet of classical poetry, and so arranged that triple time in some form or another was the result:

(1) Paul Lang "Music in Western Civilisation" p.55

<u>MODE</u>	<u>NAME</u>	<u>METRICAL UNITS AS</u> <u>GROUPED IN ORDINES</u> (1)	
		<u>Ordo 1.</u>	<u>Ordo 2.</u>
1.	Trochee — ♩ = ♩ ♩	♩ ♩ ♩ 7	♩ ♩ ♩ ♩ ♩ 7
2.	Iambus ♩ — = ♩ ♩	♩ ♩ ♩ 7 7	♩ ♩ ♩ ♩ ♩ 7 7
3.	Dactyl — ♩ ♩ = ♩ ♩ ♩	[similarly]	
4.	Anapaest ♩ ♩ — = ♩ ♩ ♩		
5.	Molossus — — — = ♩ ♩ ♩		
6.	Tribach ♩ ♩ ♩ = ♩ ♩ ♩		

Enormous importance is attached to the number three in the Middle Ages; its perfection is manifest in all divisions, especially in the Holy Trinity; it is the first number with a beginning, a middle and an end; and, in the music of the Ars Antiqua, it figures prominently, as indicated above in the table of modal rhythm.

A portion of a Thirteenth Century Motet is given on the following page, in order to show how this theory of modes applied in practice:

(1) The ordines correspond to catalectic lines in verse, i.e. lines in which the last foot is truncated. It follows that every Ordo must end with a rest. See The New Oxford History of Music, Volume II, p.320

MOTET: SCHOOL OF NOTRE DAME (13thC.) (1)

[Triplum] Erz rorz Diu! que que-rus di — e, Quant voi l'hebe —

[Motetus] Quant voi la rose es - pa - ni - e, L'her - be vert et

[Tenor] Eius in oriente

vert — et le — rans cler, Et le ro - si - gnos — chan-ter,

le - rans cler, Et le ro - si - gnos — chan-ter

Eius in oriente

The most significant fact of this polytextual motet is that it is rigidly organised throughout by the use of the first rhythmic mode; and in this intellectual organisation of structure, may be seen the common element between it (as an example of the great Parisian School) and Aristotelian Logic. There would seem to be no particular aspect of Aristotle reflected in musical composition and theorising of this period, only the common denominator - Mind. Thus within the limits of partial inquiry and analysis, it may be conceded that Leichtentritt is justified in his assertion.

- CHAPTER FOUR -

SIMILARITIES - II.

Analogical

Analogy is the recognition of a common form and structure in unlike things. It dominates this chapter which seeks for possible likenesses in music for established facts of logic. The sub-divisions are -

- I. Music as a form of thought.
- II. The Musical Syllogism.
- III. Symbolism.
- IV. Terminology.
- V. Utility.

I. MUSIC AS A FORM OF THOUGHT.

"No analogy is co-extensive with its prototype, and no musician would claim that music can state propositions, still less prove their truth or error, argue syllogistically, or draw deductions, but he is prepared to assert that music is a form of thought, and that being a form of thought, it must employ the same processes of thinking as far as the subject matter allows, and that any thought process is to that extent logical."

In this quotation from "Man, Mind and Music" (i), Frank Howes denies any particular relation between logic and music, but affirms some universal likeness to be found in all activity that grows from the intellect, whatever the subject matter. Thus the 'same processes of thinking' employed by logic and music lie not in psychological or physiological phenomena, but in the means by which the resultant end-product may be free from inconsistency or incoherence. Leichtentritt (ii) regards the emergence of logical coherence in music as one of the most amazing discoveries, for the subject matter of music is simply Sound, in isolation, in succession, in combination; and to associate this "fleeting, unsubstantial motion of the air with logical coherence seems absurd yet the invention of counterpoint, the conception of form, pointed out the right direction for the solution of this tremendous and difficult problem". Elsewhere (iii), he refers to musical logic being a compromise of unity, continuity and variety, derived from the fusion of a "logic of harmonic progression, a logic of melodic structure, and a logic of timbre." (iv)

(i) p.79.

(ii) "Musical Form" p.224.

(iii) Ibid p.241.

(iv) The meaning of the word 'logic' here, is taken to be that of ordinary discourse - no parallelism of logical procedure is intended.

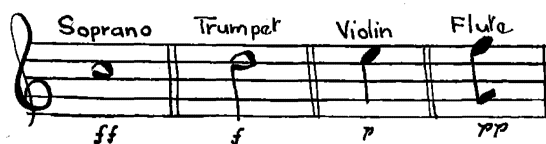
Howes' observation, written in 1948, serves to emphasize that the meaning of 'logical' in his essay is that of everyday use. One wonders whether Howes, an English critic, lecturer, editor and writer on music, is aware of the attempt, in 1926, to relate music to logic in the particular aspects mentioned in the first part of the quotation on page 22, namely, in the ability of music to state propositions, to prove their truth or error, and to argue syllogistically; or, being aware, refuting by saying "no musician....."

II. THE MUSICAL SYLLOGISM.

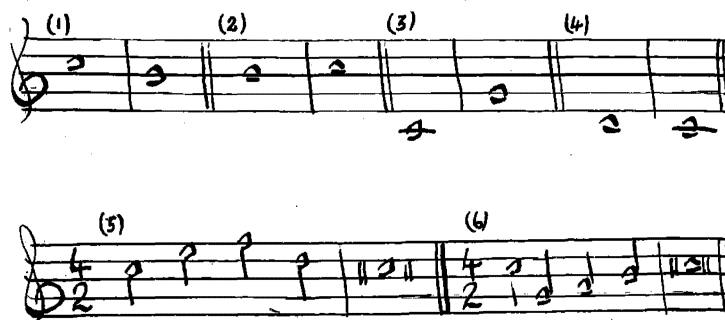
Attracted first to a series of articles by Dr. E.H. Turpin, called "The Logic of Counterpoint" wherein it was stated that the Art of Counterpoint stands in exactly the same relation to musicians in particular, as the Art of Logic stands to mankind in general; and later to Archbishop Whateley's "Elements of Logic", Dr. Charles W. Pearce was led, after "reflective perusal" to state (i) the musical syllogism, thus -

(i) "Students' Counterpoint" Preface pp.vii-viii.

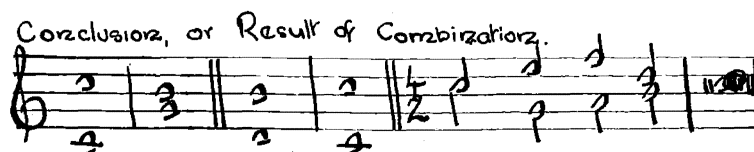
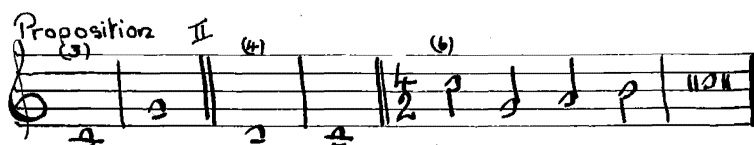
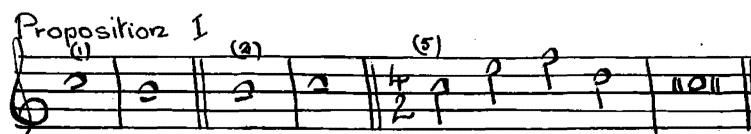
1. The simple term of logic finds its analogy in the single sound, which differs according to pitch, intensity, quality and duration.....



2. The proposition finds its analogy in melodic progressions organised on the basis of relative position in the diatonic scale, tonal connection and accentuation.....



3. The syllogism finds its analogy in an act of musical reasoning or calculation, forming a new judgment as the result or conclusion of that union of melodies when heard simultaneously...



COMMENTS:

1. THE MUSICAL TERM. In proposing to call a sound, a term, Pearce gives no indication of possible equivalents for connotation, denotation, intension and extension - for they are unnecessary for his purpose; but for the purpose of this present inquiry which is to find all likely relations between logic and music, with the view of justifying reference to logical procedures in music, there is a need to extend this analogy of Pearce, so that the comments to follow on the term, proposition and syllogism, will include more than a mere analysis of his views.

If denotation considers the term in the sense of the collective membership of a class of objects, and connotation as a set of characteristics which determine the objects, we offer as a musical equivalent of the former, instrumentation, which affects timbre, i.e. the quality of the sound is dependent on the specified class of voice or instrument (e.g. male, female; string, wind, percussion); and for the latter, we offer notation which affects the remaining properties of the musical sound, i.e. frequency, intensity and duration is defined by clef, staff, shape of note-symbols, tempo and dynamic markings.

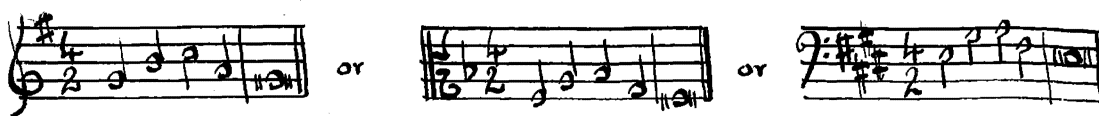
Further, if in logic, a distinction is made between

intension (either objective - referring to all the characteristics possessed by all the members of the class; or subjective - referring to a selection of characteristics which vary according to context and situation), and connotation; and between extension (referring to classes, not individuals), and denotation; then in music, we may distinguish an objective intension of a musical sound as indicative of all the ways possible for that sound to possess variations in pitch, loudness and duration; a subjective intension of a musical sound as indicative of what a person is aware of in hearing any one sound; and an extension of a musical sound as indicative of the various classes of the production of sound e.g. vibrating air column, vibrating string.....etc.

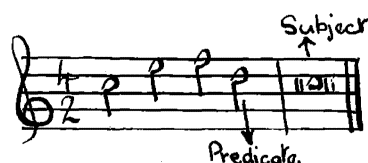
Therefore, there seems to be justification in referring to a resemblance between a logical term and a musical sound, so that, if one wished, one could quite truly speak about a musical term in a logical sense.

2. THE MUSICAL PROPOSITION. Whereas in logic, the same proposition may be stated by using different sentences - e.g I have a dog, Ich habe einen Hund, J'ai un chien (1), in music, the same melodic progression can be stated in different keys which suggests a near equivalent for change of language. Pearce's example No. 5 on page 25 would appear thus:

(1) Susan Stebbing " A Modern Elementary Logic" p.17

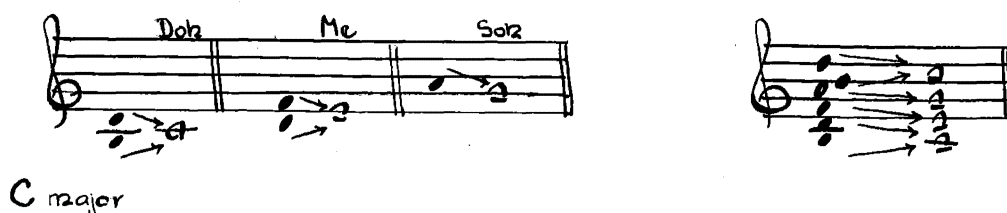


Now, one can grant that the scalar connection and accentuation may perform a binding, similar in function to that of the copula verb; what notes, though, are to be designated 'subject' and 'predicate'? When Aristotle states that all propositions either assert or deny something of something, and we reword it as: All melodic progressions 'assert or deny' notes of notes, we would need to classify the sounds of the diatonic scale according to some such division as proposed by Macpherson and Read (1), i.e. into sounds of activity, and sounds of repose - the former being attracted by the latter. Taking the last two notes of Pearce's example, the note C could equal the subject because it attracts the note D, and which therefore could equal the predicate:



(1) "Aural Culture based upon Musical Appreciation" Vol. I p.74.

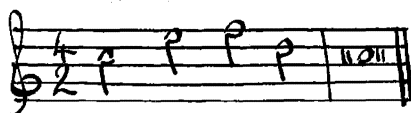
The notes of "repose", Doh - Me - Soh, attract the notes of "activity" - Ray - Fah - Lah - Te, in this way:



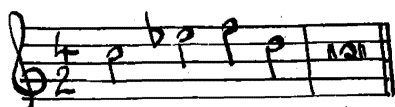
It is quite arbitrary to relate the sounds of repose with subject terms, and sounds of activity with predicate terms, although by doing so, there is a faint idea of asserting something (the note D wanting to go to the note C) of something (the note C attracting the note D). These notes of repose and activity are governed by accentuation, implied harmony, and scalar organisation, so that context is ultimately responsible for what is "active" and what is "restful".

Pearce emphasises the diatonic scale. It is, however, but one of many possible orderings of successive sounds - and although irrelevant to Pearce's purpose, these others need mention here; for example, the pentatonic, the chromatic, the modal, the enharmonic, the whole tone. But in these, there is not the cadential pull between sounds of activity and sounds of repose, so that the distinction between subject and predicate suggested above is restricted in application. The distinction itself is of no value in music, and the conclusion is that no satisfactory parallels can be drawn in music, because of the different ways in which isolated sounds may be organised into scales.

Can truth or falsity be asserted of a melodic progression? More concretely, is this progression of Pearce, 'true'?

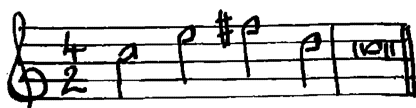


A hypothetical answer may be: If by 'true' is meant 'right, acceptable or pleasing', then this example is true. When we ask: What makes it true? an answer may be inferred from answering the question: What would make it false? for certain procedures would destroy the configuration of the example. By adding accidentals it becomes this:



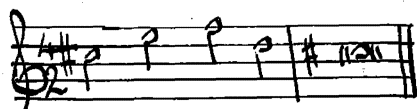
- where the major key is changed to minor. It is still acceptable.

or this:



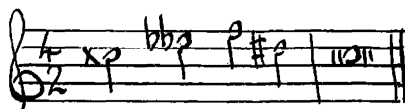
- where the unpleasant prominence given to the augmented fourth is offending and inaccurate in the key of C major. It could be made acceptable by context, in the key of G major.

or this:



- where the key of C major is destroyed, but is pleasing to the ear, because of an implied change of key to d minor, or A major.

and so on, adding accidentals of any type, to any or all of the notes, till we make nonsense:

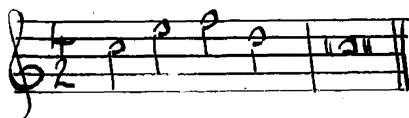


So it seems that key is important to make a progression acceptable, or pleasing, for it affects the relation of

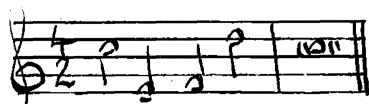
one note to another with reference to a certain tonic;
 therefore, lack or looseness of key would make a melodic
 progression not pleasing, or not acceptable or false - and
 definition of key would account for a progression being
 true.

And yet, that example given as false, as "nonsense" is
 a sample of a procedure followed by those composers who
 negate key, and who use Twelve-Tone technique - a method
 of ordering successions of sound quite differently than
 that found in the diatonic scale. Because, theoretically,
 Twelve-Tone writing does not emphasise key, do we decide
 that all music written according to Twelve-Tone principles
 is false? If "we" do decide thus, it is only "our own
 personal opinion", for there are in fact those who decide
 otherwise. So that the notion of key is not basic for
 asserting truth or falsity of a progression.

Can the example be destroyed, or falsified, if the
 notes are placed at different octave registers? For ex-
 ample, the Pearce progression -



may become this:



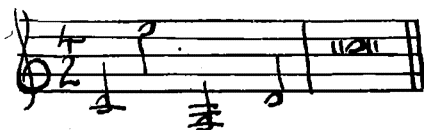
or this:



- but it is still right,
 or pleasing.

- it seems inconsistent
 to choose the last
 note so far away from
 the others

or this:



- the notes appear
unrelated to one another.

The more grotesquely the notes are separated from one another, the easier it is to think that this is a clue to calling the progression, false; and yet, again, that 'falsity' is 'truth' in certain styles of composition. If then the very same progression is acceptable in one style, but not in another, the notion 'true-false' would seem to depend on reference to fact, as does a logical proposition, but where fact is to be interpreted as faithfulness to a particular style, period or technique of musical composition. Thus a true musical proposition would be authentic to a chosen standard, while a false musical proposition would be non-authentic, or spurious. Therefore, the example at the end of page 29 may be described as 'true' because it obeys certain principles accepted as General Practice in the diatonic, classical style.

This gaining of objective verification is important for musicians. On pages 30 - 32, these words have been used in the discussion concerning melodic truth or falsity: Right, acceptable, pleasing, offending, nonsense, inaccurate - words which are subjective and slightly emotive. As the notion of true-false is central to a logical proposition, so the notion of authentic-spurious

could be central to a musical proposition. Not primarily the fact that a certain progression is pleasing or otherwise, but the fact that it conforms to some particular style of composing or historical period, irrespective of that style or period in question being pronounced pleasing in some degree by its initial adherents and subsequent propagandists. This finding could be of considerable value in music.

Because of the lack of suitable 'subject' and 'predicate', a musical proposition lacks also quality and quantity, distribution of terms, equivalents to simple, compound and general propositions and to the traditional forms of immediate inference. Yet, in spite of no subject and predicate, inversion is an important procedure in music. How does it compare with logical procedure?

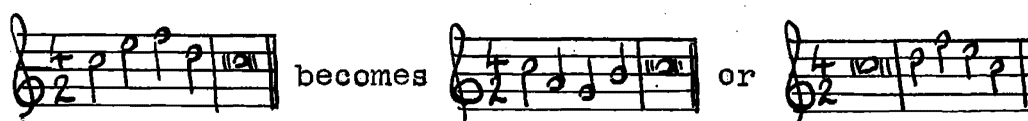
In logic, inversion is the process of immediate inference in which from a given proposition another is inferred having for its subject, the contradictory of the original subject, thus:

<u>A. Universal Affirmative:</u>	All S is P
Obversion	No S is non-P
Conversion	No non-P is S
Obversion	All non-P is non S
Conversion	Some non-S is non-P (partial)
Obversion	Some non-S is not P (full)

In example, this becomes -

All logicians are intelligent.
 No logicians are unintelligent.
 No unintelligent people are logicians.
 All unintelligent people are non-logicians.
 Some non-logicians are unintelligent.
 Some non-logicians are not unintelligent. (1)

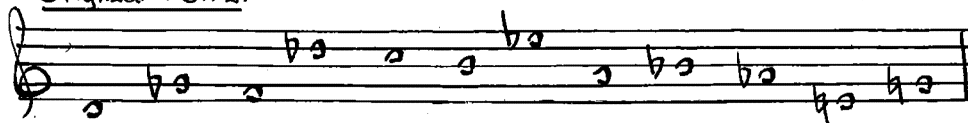
In music, a progression is inverted simply by turning the whole of it "up-side-down" or "back-to-front", thus:



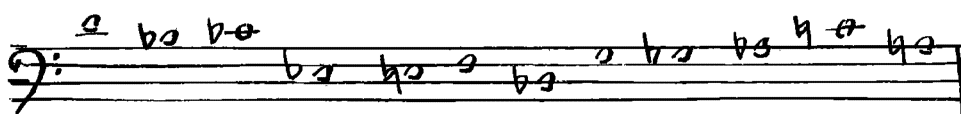
Inversion in music, although the result of a different procedure than that in logic, nevertheless is based on the idea of changed relations, which constitutes one bond with logical procedure; and the idea of the original progression generating others in the sense that these others are inherent in the original constitutes another bond. In short, inversion in music, no less than in logic, is a means of inference. (11) It is not usual to talk about inference in music, but rather, about invention or development; yet inference seems fitting to describe the procedure of Twelve-Tone writers, for does not Krenek "infer" from this Tone-Row, when he uses inversion, retrograde, retrograde inversion, or inversion retrograde?

(1) Intended as a contradictory, not as a contrary.

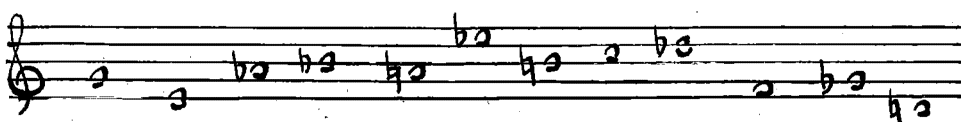
(11) There is no equivalent to the Figure of Opposition.

Original Form.Derivative Forms.

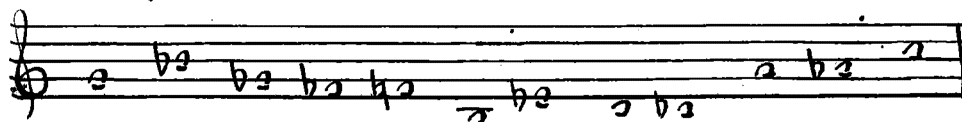
(a) Inversion:



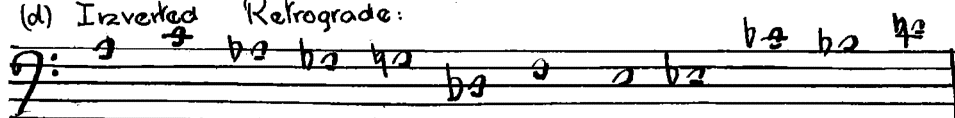
(b) Retrograde:



(c) Retrograde Inversion:



(d) Inverted Retrograde:



(i)

Another type of inversion in music, is the result of two melodic progressions changing position, so that the higher becomes the lower, or vice versa, by one part moving up an octave, tenth, or twelfth, or down similarly.

(see example next page.)

(1) E. Krenek, "Studies in Counterpoint" Chapter 1.

Model:

Inversion or 15th

As we could speak quite truly about a musical term in a logical sense, so we could speak about a musical proposition (i.e. a melodic progression) in a logical sense, though this sense is restricted, and is based on musical parallels for "true-false" and one form of inference, by "inversion". It is a pity that no likeness can be found to logical propositional form, for it would constitute an important one. But when a musical proposition uses "form", it is that of a melody being balanced by twin principles of repetition and contrast of a purely musical nature; and the question: When does a musical proposition become a melody (as distinct from melodic progression) raises considerations irrelevant to this thesis.

3. THE MUSICAL SYLLOGISM. Whereas the method employed in stating a musical syllogism

is that of simultaneously sounding musical propositions (of which there must be at least two in number, but can be more), that employed in a logical syllogism is successive statement of three propositions, one being a conclusion inferred from two premisses. This conclusion is new knowledge. What is new knowledge in the musical syllogism? Pearce does not go beyond saying " a new judgment as the result of that union of melodies when heard simultaneously". In the examples he gives, and they could not be otherwise because of the nature of music, the two propositions stated simultaneously as the conclusion are the same two melodies that have been used separately, so that what is new is not another melody (i.e. another proposition). Melody illustrates the horizontal aspect of music, but with two melodies presented together, there is introduced the vertical aspect of music, which defines to a greater degree than pure melody such things as tonality, key, chord progression and allegiance to some norm of consonance-dissonance. A musical syllogism gains more from Gestalt Psychology at this point. Logic emphasises the effect of argument, the conclusion is extracted from the premisses, but differs from them in the regrouping of terms. But music includes its premisses simultaneously in its conclusion, so that the whole is something more than the sum of its individual parts - it is not the result of regrouping.

So that if we decide to admit the possibility of

there being a musical syllogism, there is a similarity with the logical syllogism on the grounds that something new can be the result of certain propositions put into a certain relationship. However, this something new is arrived at by quite different means - in logic, by argument; and in music, by harmony.

Susan Stebbing states (1) that the three defining rules of the traditional syllogistic argument are -

1. Every syllogism comprises three propositions.
2. Each proposition in a syllogism must be in one of the A.E.I.O. forms.
3. Every syllogism contains three, and only three, terms.


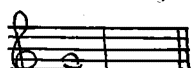
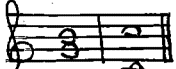


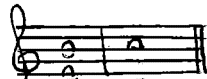
But, as noted on the previous page, a musical syllogism may involve a varying number of propositions; and logical propositional form finds no satisfactory parallel in music; while distinctions for major and minor premisses and for the middle term.

Thus, can we rightly talk about a syllogism in music? Howes points out one weakness: We cannot argue in music, when music is considered as sound. But let us take matters a little further.

A logical syllogism differs in figure, according to the position of the middle term, and in mood which is determined by the quantity and quality of the propositions involved. It yields a valid conclusion if certain axioms of distributions and quality are not violated.

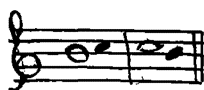
(1) "Modern Elementary Logic" p. 55.

Now if validity depends on form, and the musical proposition has no such particularised formal emphasis in this sense, can a musical syllogism have validity? If so, on what does it depend, and what would cause invalidity?

Not every two (or three, etc.) musical propositions will be acceptable for simultaneous expression. If to this proposition no.I given by Pearce :  is added this as proposition no.II:  the conclusion would be:  and this result would be acceptable to people in class A. But if this is given as proposition no.II:  so that the conclusion is:  the result would not be acceptable to people in class A (1). For while the notes in both suggestions for Proposition II are dominants and tonics, they are not in the same key; so is "key" what is meant by "that common bond of tonal relationship" mentioned by Pearce? Not necessarily, for if the dominant-tonic progression of a minor be fused with the leading note-tonic progression of C major the result would still be acceptable to people in class A:  and in this lies the clue for validity, for this acceptability is the outcome of a certain outlook on consonance and dissonance. If this is so, then the interval relationship between the propositions would be accepted or rejected according to the norm of consonance-dissonance held by musicians. Consequently, proposition I (no. 1 on

-
- (1) Assuming class A to have membership; and implying that there are people in another class, B, and to whom the conclusion would be acceptable.

on page 25) plus proposition II (no. 2.) would yield



and would be accepted by those working within a style weighted on the side of dissonance, as for example in the Twelve-Tone technique, but would not be accepted by those working within the classical style as ordinarily understood. This subject of the relation of consonance to dissonance is an important one when considering the various aspects underlying composition and the teaching of composition; and as the relation changes according to historical period, style and technique, we may say that the musical syllogism has validity in so far as it conforms to the standard of vertical consonance-dissonance existing within a chosen period, style or technique (which, it may be recalled, determines also the truth of a musical proposition mentioned on page 32).

In taking the musical syllogism this far we have gained the idea of "validity" - not the formal validity of logic, but an historical and aesthetic equivalent; and because the propositions of a musical syllogism do not lose their individuality, either as premiss or conclusion, we have one means of testing validity in all music of a contrapuntal nature, by examining the various melodic progressions for "truth" and their combination for consonant-dissonant allegiance. This procedure is followed in music, but under the name of "Two-Part Horizontal Analysis".. (See example on page 71.).

On page 38, doubts were raised as to whether we can

properly talk about the syllogism in music. It has been pointed out that there are two points in common with a logical syllogism: (1) the producing of something new that was inherent in the propositions; and (2) the notion of validity. Would these be sufficient to justify the use of the term? One hesitates to say yes or no. It would depend on context, as for example, when a person consciously uses verbal symbols about the music in order to examine its wrongness or rightness; but the music itself cannot reason syllogistically, or prove a fact by way of the syllogism, and it is this lack of an ability to argue which reveals the weakness in talking about the "musical" syllogism.

Again, the idea may have been created that the procedure in writing a "musical syllogism" is to take musical propositions in their entirety, and only then presenting them together, confident that the result will be in conformity with the prevailing standard. But the more likely procedure is to write portions of each proposition, modifying one or other so that the conclusion will be acceptable, or valid. In a logical syllogism, there is not this malleability, due to its formal properties. And here, purely musical questions arise, when does a musical proposition equal a motif (as few as two notes), a section, a phrase, a sentence? In point of fact, it could equal all of them.

We may conclude that Pearce is justified in drawing

the analogy, but remark that it breaks down when the fact is considered that music is not ratiocinatory.

III. SYMBOLISM.

When C.S. Peirce wrote that "The woof and warp of all thought and research is symbols, and the life of thought and science is the life inherent in symbols" (1), it is open to question whether he actually considered music for inclusion within "all thought". But once it be granted that music is a form of thought (see page 22 ff.), it is true to say that "the life of music is the life inherent in its symbols" when those symbols guide the subsequent re-creation of music.

However, it is not in notational symbols, but in those used in the teaching of elementary composition, and in the analysis of structure or form, that the abstract relations, essential to logic, find a resemblance in music.

It is not presumed to see in the use of these symbols any equivalent to the generalising power of modern logic, a power due largely to the refinement of the symbolism which it has adapted for the task; nor is it suggested that the need for musical symbolism is the same as the need for symbolism in logic, where a specially devised symbolism is essential in order to "avoid the distortion which may arise from the emotional and intellectual

(1) Collected Papers, Volume II p.129.

overtones of ordinary words, to restrict as much as possible the vagueness of common symbols, and to prevent the often subtle transformations which the meaning of verbal symbols undergoes" (1). But if it has been granted that a sound is analogous to a term in logic, and if certain symbols be agreed upon to represent a term, both in a logical and in a musical sense, then the advantages of symbolism should be apparent in music no less than in logic. These advantages (which include distinction of meaning, concentration upon what is essential, emphasis on what is constant, and saving of labour and thought), are seen in the symbols used for chord indication and figuring. So that when Roman numerals are used thus: "I, i, i°, I' " to indicate the possible triads on the first degree of the diatonic scale; or thus: "II, ii, ii°, II' " on the second degree, and so on up to the seventh degree (the limit), the symbol concentrates on the quality of the triad, and of its relation to a tonic. It does not draw attention to the variables such as doubling, arrangement or key, and with the addition of a small letter "a, b, c" or "d", it is a labour-saving way of indicating position, quality and scalar relationship. For example. "Ia" is equivalent to writing "the root position of the major

(1) "Introduction to Logic and Scientific Method"
Cohen and Nagel, p. 221.

triad on the tonic". "Ia" is an empty schema into which may be fitted particular notes that have the relations to a root as specified by the symbol - in this case, the relation of a major third, a perfect fifth, and a perfect octave above the root. The whole is determined by musical factors of key, metre and rhythm, but even so, in teaching chord progressions that embody the general, common practice of some accepted period for study, it is of value to emphasise the relationship of roots, irrespective of actual notes. Thus "vi - ii - V - I" serves a like purpose for music, as "A" or "SaP" or "All S is P" for logic, i.e. not specification of classes (in music it would be notes), but specification of a certain relationship holding between any classes (or groups of notes). When occasion arises, the symbols are filled out into examples; so that "vi - ii - V - I" in F major becomes in elementary work:



and "All S is P" becomes "All musicians are mortal".

Again, when Arabic numerals are used in music (e.g. 6, 4, 7-6), there is concentration on the intervallic relationship of the notes wanted above a given bass note -

not particular notes. The emphasis is on the relation of the notes to a bass, not to each other; and it is an easier way of writing "the first inversion of a triad", or "the third inversion of a chord of the seventh", or "the seventh falling to the sixth while the third remains". In figuring, there is no defining of the quality of the chord or of the intervals, unless it is referent to a bass which in its turn is referent to a clef and key signature.

A simple illustration of figuring in music is the schema 65, where attention is drawn to the fact that the ⁴³sixth above the bass proceeds to the fifth, and the fourth to the third (according to commonly accepted practice); there is no reference to any particular notes, only relationships between upper parts considered severally with the bass - not each other. Filled out in notation, in the key of C major it becomes:

or this

or

C: 6 - 5
4 - 3

6 - 5
4 - 3

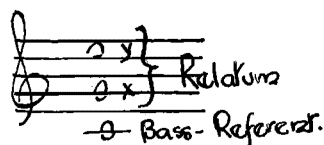
6 - 5
4 - 3

Finally, in analysing the structure of a complete composition, or portion of a composition, or in considering what constitutes the standard structure of particular forms in composition, one may resort to an alphabetical

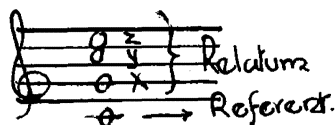
symbolism that shows the relation between the similarities which can be noted broadly within the work. Thus, A -B -A shows that the overall plan is that of a contrast separating two statements of something similar; and into this mould there may be fitted a simple folk-song, a Chopin pianoforte composition, or a minuet and trio from a Haydn symphony, to mention but three examples. Here, as in the examples of musical symbolism that have been considered, it is not the music itself which engages the attention, but the relations existing between its component parts.

With so much stress laid on relations, we may consider whether the logical properties of relations have any counterpart in music.

"If relations relate terms" in logic, then "relations relate sounds" in music; and equating the number of terms with the number of parts (i.e. melodic strands sounding at any one time), we have dyadic relations existing in two-part writing, triadic in three-part, and polyadic in four-part and more. If every relation in logic has a sense or direction from referent to relatum, a musical example of $R(x,y)$ is the following, where R = the position above a bass (i.e. the lowest sounding part), and x,y , the two notes (or parts in an extended example) in ascending order:

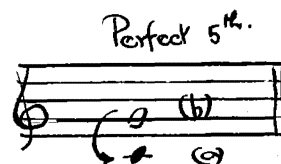


while $R(x,y,z)$ would be:



A fundamental relation in music written in two or more parts, is that of the bass to its upper part(s), (with the converse, of upper part(s) to the bass). This spatial relation of above-below entails intervallic relations of concord-discord; but it is not easy to pursue logical distinctions of symmetry, transitivity, and connexity, because, no matter what the basis for altering the spatial relation of sounds (or terms), i.e. no matter what part is transposed up or down - the resultant intervals are still considered from the bass upwards. E.g. -

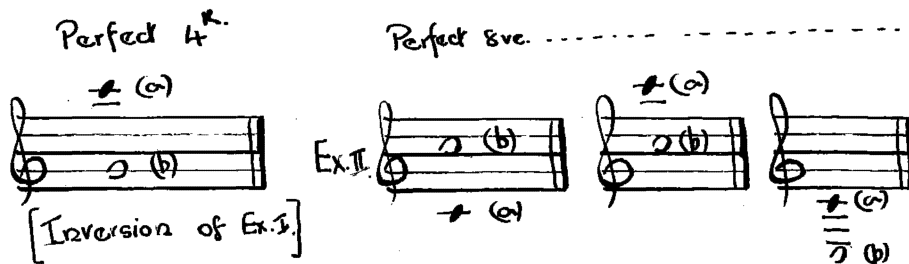
A relation R is symmetrical when $R = R^c$; thus if xRy , then yRx . So that if note (a) is a certain interval - say, a perfect fifth - below another note (b), then the converse is that note (b) is that same certain interval - the perfect fifth - above note (a)



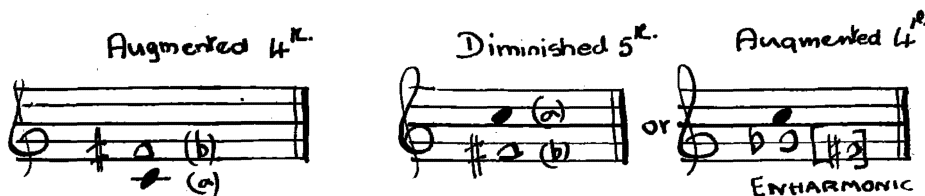
In all cases the intervallic relation is unchanged, and thus all intervals, when uninverted, are

symmetrical.

But if the spatial relations are changed by inversion - say, at the fifteenth - in order for note (a) to be above note (b) where before it was below, and vice versa, in one case only does the intervallic relation remain unchanged - in that of the octave; so that in this one case, the relation is symmetrical, in all the others, the relation is asymmetrical



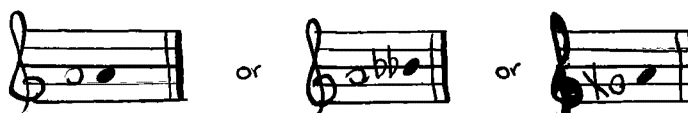
While in a special case, employing enharmonic change (1) the relation is non-symmetrical, so that if xRy then perhaps yRx and perhaps not



The notion of transitivity is not applicable, but that of reflexiveness applies to the

(1) Change of letter name, but not of pitch.

unison, both diatonic and enharmonic, in the sense of a sound being identical with itself as far as pitch is concerned.....



It is clear that there are no worthwhile musical equivalents of logical properties of relations because of the non-conceptual nature of music.

+ + +

The aim in considering symbolism has been to show that common traits of usage are apparent; there has been no wish to find musical equivalents of particular symbols used in logic. But before leaving this section, we would like to point out a certain procedure in music, which has been compared with the use of the formulae encountered in the consideration of the logical syllogism.

Using S, M, P, to stand for minor, middle and major term respectively, the form of a syllogism in Figure One can be symbolised in this schema -

$$\begin{array}{r} M - P \\ S - M \\ \hline \therefore S - P \end{array}$$

into which may be accommodated these moods: A A A (Barbara), A I I (Darii), E A E (Celarent) E I O (Ferio) in order to secure a valid argument. For example,

choosing Celarent, an illustrative verbal symbols becomes

- E. No musicians are miserly.
 A. All small-minded people are miserly.
 ∴ E. No small-minded people are musicians.

When discussing the musical syllogism on pages 36-42, we illustrated with actual musical examples, and made no distinction between the syllogism in example and the syllogism in formula, comparable to that found in the logical syllogism. Most of the musical examples, short as they were, were examples of First Species Counterpoint, because they illustrate note-against-note writing, with an emphasis on consonant intervals above the bass.

Chas. W. Pearce believes that "there are few apparently elaborate musical passages which are incapable of being reduced to a simple syllogistic formula" (1), i.e. to First Species Counterpoint in effect. For example, he

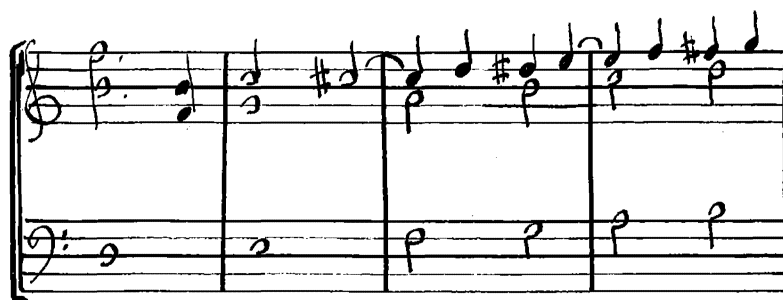
Beethoven op. 53

gives -



(1) "Students' Counterpoint" preface p.ix.

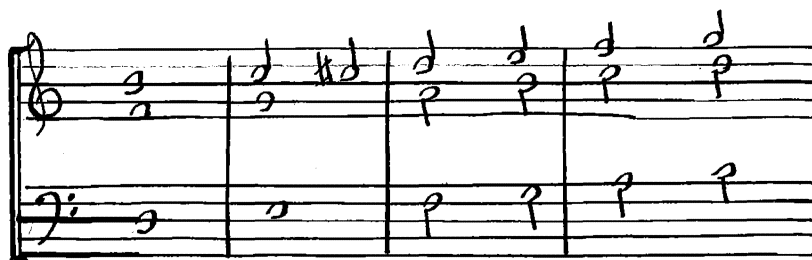
which, reduced to its "simplest syllogistic form" may be expressed as.....



(i)

It is clear by this example, that the nearest music can offer to the several syllogistic formulae of logic, is this reduction to essential notes, which Pearce calls "the art of musical reasoning or calculation". (The word "reasoning" in this context is, surely, to be taken broadly - for it can claim no particular affinity to logic any more than it can in the context of calling the reduction of an apple pie to its ingredients, the "art of culinary reasoning or calculation".)

(i) Actually, this is not the simplest: but this



IV. TERMINOLOGY.

A certain amount of terminology is common to both logic and music, viz. -

Antecedent
Consequent
Copula
Form
Inversion
Mood
Species
Subject

but investigation reveals that linguistic changes by generalisation and specialisation are responsible for wide differences in application; so that although there are apparent similarities, they are mostly of a verbal nature. An exception has been noted in the case of "inversion" (pp. 33-36) with reference to inference in both logic and music; and "antecedent-consequent" will be shown to have a common reference of usage on pp. 74-75.

One would have expected that the word "form" - basic to logic and music alike - would have shown a close analogy; but musical form and logical form are themselves but particular examples of a generalised concept of Form, and quite properly, both could illustrate the ideas embodied in the Gestalt School of Psychology, or an abstract philosophical discussion on the nature of form.

In case it be asked: What is form in music? we may cite from "Musical Form" by Hugo Leichtentritt in answer.

Leichtentritt bases his work on the "aesthetic premise that a mass of sound gains artistic value primarily by a sensible, rational form, a certain amount of construction". He distinguishes between Form and Forms - "Form is something abstract, comparable to the Platonic Idea, whereas Forms are concrete examples of the idea. As in idea, form is unchangeable in every style and ageit is immutable,.....the various forms are changeable and malleable; they are classified, well defined special types, described with the help of a structural formula different for every style and type" (1). And so, in music, we have such structural formulae as Binary, Ternary, Rondo, Sonata, Variation etc. It is this specialised meaning of form in music, demonstrable by example, that offers itself for likeness in logic; but whereas in logic, form is essential for determining validity, in music, form is essential for determining coherence and intelligibility.

V. FINAL ANALOGY: UTILITY.

The likenesses mentioned so far have concerned no one aspect of music: the analogy now to be mentioned concerns a particular aspect of music - Counterpoint. The analogy has been stated by Chas. W. Pearce (ii) who

(1) "Musical Form" pp. 3 and 454.

(ii) "Student's Counterpoint" preface p.5.

enumerates the "most striking features of resemblance between the Arts of Logic and Counterpoint" thus:

- " 1. The syllogistic principle of thought-presentation.
2. Usefulness as a method of thought-analysis.
3. General application to thought processes.

With respect to external difficulties and erroneous views of students and others, it is observable that both arts suffer from -

4. Over-estimation of their proper province and function.
5. Under-estimation of their practical usefulness.
6. Preference of unaided common sense to knowledge and experience gained by the use of systematic principles.

Further analogy may be seen in -

7. Their academical aspect.
8. Divergence of opinion respecting rules etc."

Here, Pearce is referring to that type of counterpoint known generally as "strict". We feel that these features listed by Pearce are indeed true resemblances, needing no further comment; for points 1, 2 and 3 have received examination in this chapter; points 6, 7 and 8 are self-evident to those who are conversant with the teaching of either/both logic and counterpoint; while points 4 and 5 receive mention on pages 62-67.

+ + +

The similarities between logic and music are not many, but those that have been indicated in this chapter, encourage one to consider them as being not entirely negligible. It is now fitting to mention some of the

- CHAPTER FIVE -

LOGIC APPLIED TO MUSIC

In the Introduction to this thesis (page 5) it was stated that the logician as logician, has no need of music. Because music can be divided into the music itself (i.e. the actual sounds or their equivalent in symbols), and all that which is about music; and because it is as possible to use verbal notions about music to illustrate a point of logic as it is to use verbal notions about any subject whatever, it is tantamount to stating that the logician as logician has no need of music as sound or its notational equivalent.

This statement arises from the noticeable non-appearance of examples of musical composition in books, articles etc. concerning logic. Is this non-appearance deliberate or accidental? Could the music itself illustrate a point of logic?

The complementary statement on page 5, concerning the apparent need of logic by the musician is an assumption based on the frequent appearances of the word "logic" and its derivatives in literature concerning music. Does this statement intend reference to the musician who

writes and talks about music? i.e. the historian, the critic, the essayist, the musical philosopher, because of the role played by verbal symbols? or does it also intend reference to the musician who uses the actual sounds? i.e. the composer and the teacher of composition? A fine distinction, when he who writes about the music must needs refer to the music itself.

This chapter is concerned with indicating some of the ways in which logic, in some one aspect or another, has been, or could be applied to music:

I. Generally;

- II. Specifically (a) indirectly to the music itself, by way of verbal symbols;
(b) directly to the music itself.

+++

I. INSTANCES IN WHICH LOGIC HAS BEEN APPLIED TO "MUSIC" IN THE GENERAL SENSE.

(1) LOGICAL DIVISION:

(a) In discussing the English Madrigal in relation to other forms of choral-song, Dr. E.H. Fellowes appeals to logic when mention is made of the restrictive use of the term "Part-Song" -

"It is difficult to discover the origin of this restricted use...Nor can such limited use be supported on logical grounds. Song as a musical term, and as applied to the secular branch of vocal music, must necessarily be subdivided into (a) Solo, or Unison Song, and (b) Part-song. Part-song should be in its

turn, be subdivided again under the headings of Polyphonic Part-song and Harmonic Part-song ..."

(1)

(b) In introducing the subject matter of musicology, Dr. Glen Haydon writes -

" The subdivisions of systematic musicology are based on both logic and convenience....."

(11)

Logical division, however, is a device to be employed wherever a specified importance is relevant to some practical purpose, no matter what the subject matter; so that it is not a matter of justification when writers on music rely on the principles in accord with which a sound division should proceed - but a matter of indispensability.

(2) METHODOLOGY:

(a) "Musical theory has been wrecked again and again by efforts to base it upon natural acoustic principles. The attempt is vain, as are all attempts to reduce art to science. In as far as theories of harmony go beyond empiric observation of the practice of the great masters, they tend towards uncontrollable pseudo-scientific speculations".

(111)

(1) "The English Madrigal Composers" p.13.

(11) "Introduction to Musicology" Introduction p.9.

(111) "The Integrity of Music" Sir Donald Tovey, p.45.

- (b) "In the last part of my book I have endeavoured to show that the construction of scales and harmonic tissue is a product of artistic invention..... The history of music shows us that the same properties of the human ear could serve as the foundation of very different musical systems."

(i)

- (c) (Concerning the musical principle of classical tonality.)

"But it is evident that this is merely an aesthetical principle, not a natural law. The correctness of this principle cannot be established a priori. It must be tested by its results. The origin of such aesthetical principles should not be ascribed to a natural necessity. They are the invention of genius."

(ii)

In various articles (iii), Ll.S. Lloyd has demonstrated the fallacy resulting from the a priori theories in music which do not start with musical premisses. Instead of advancing, tentatively, some hypothesis to be tested, in all possible ways, the a priori theorist lays down a postulate, intending it to be accepted, unless and until

- (i) "Sensations of Sound" Hermann von Helmholtz - as mentioned by Ll.S. Lloyd in "Scientific and Pseudo-Scientific Theory", Grove, Dictionary, Volume VII.
- (ii) Ibid.
- (iii) "The A Priori Theorist and Music" - Music and Letters 1945.
 "Pseudo-Science in Musical Theory" - Proceedings of the Musical Association. 1944.
 "The Musical Ear"
 "Music and Sound"
 "Theory Scientific and Pseudo-Scientific" - Grove Dictionary of Music and Musicians, 5th. Edition.

someone else proves it to be wrong. Lloyd cites as examples A.J. Ellis and his duodenies; Colin Brown and his "discovery" of the notes of the diatonic scale: and Rameau's generateurs which were developed by others, particularly Dr. Day, into the theory of the fundamental bass (1), a bass described by Tovey as "imaginary, giving 'roots' to all the essential chords of the music above it, but a conception true only of the most obvious harmonic facts; beyond them, it is as vain as the attempt to ascertain your neighbour's dinner from a spectrograph of the smoke from his chimney". (11)

II. INSTANCES IN WHICH LOGIC COULD BE APPLIED TO "MUSIC" IN A MORE SPECIFIC SENSE:

- A. Indirectly to the music by way of verbal symbols;
- B. Directly to the music expressed in notational symbols.

SUB-SECTION A.

"To determine what makes an object beautiful, sublime or possessed of what has been called esthetic form, is the problem for the study or theory of art, of which esthetics is a part, although the latter also studies natural beauty that is not the object of art. The logician is interested only in noting that such a study involves both factual considerations experimentally determined, and purely logical considerations of consistency".

(111)

(1) A simple illustration occurs in "Rudiments of Music" C.H. Kitson, p.37, in a description of the notation of the harmonic chromatic scale.

"If logic and scientific weighing of evidence are not the whole of intelligible artistic judgment, they are necessary ingredients of it".

(1)

In the comparison and estimation of musical values, the tendency is to judge on a personal basis - the very process of hearing music arouses feeling in the listener, and thus it is the subjective element that has a decisive effect on our judgments. But the musician whose concern is musical criticism must be prepared to put aside personal feelings where an assessment of the music as music is required - and assessment can be objective only in so far as logical considerations of truth, validity, consistency and coherence are applicable.

By keeping in mind: (a) that subjective criticism arises from personal feelings, and that (b) objective criticism arises from regard of applied logic, readers of musical criticism are in a position to appraise that criticism and the music to which that criticism is relevant.

The advantage resulting from the inclusion of logic and scientific weighing of evidence as being necessary to

Previous page references, continued:

- (ii) "Musical Articles from the Encyclopaedia Britannica" p.62.
- (iii) Cohen and Nagel "Logic and Scientific Method" p. 362.

(1) Ibid, p.361.

musical judgments as they are expressed by historians, essayists, critics and those others who refer to the actual music by verbal symbols, is a gain of perspective - especially desirable in emotionally-involved subjects.

"Those others" mentioned above, include teachers and students of elementary musical composition; and the remarks to follow may serve to indicate how necessary it is to cultivate an objective approach.

A course of composition as ordinarily understood, lays stress on the avoidance of consecutive fifths and octaves, and the avoidance of ambiguity of key resulting from false relation of essential notes. This must necessarily be so, because such a course of composition is based on the prevailing practice of the composers who adhere to that particular style and method of composition. But there are students who do not know (presumably because they have not been told), or will not accept that they are following a style - which is but one of many, and who, consequently, think that what they avoid, or what is "wrong" holds for all music, no matter whether written now or centuries ago. They think in universals instead of particulars, with these results: either they delight in pointing out the "wrongness" of the consecutive fifths in Early Organum, or in the music of Vaughan Williams, and the "wrongness" of the false relations in the English Madrigal Composers, when

they may find themselves in the position of being confronted with the printed score of this music; or they take umbrage at restrictive discipline, and pointing to such examples, say "Why can't I do it?" and thereupon proceed to do it out of context of style.

A particular aspect of music to benefit from objectivity is the teaching of counterpoint, a controversial subject in musical pedagogy since the beginning of this century.

There are at least two methods of teaching counterpoint. One known as the "Direct Approach", or "Sixteenth Century Counterpoint" - or more particularly, "Palestrinian Counterpoint"; the other known variously as "Strict", "Academic", "Scholastic", "Species" or "Fuxian Counterpoint". The controversy concerning the relative merits of each, with the aim of establishing the one as the better, or defending the other as the basis of training undergone by great musicians, is nourished by the confusion resulting in part from the use of the word "Strict" to include both methods, in part from a lack of knowledge regarding the connotation and denotation of the word "Counterpoint", and in part from a non-recognition of purpose.

Use of logical procedure and scientific method lay bare the fallacies of argument directed against one or other of the methods, and point to false premisses exist-

ing within the two systems themselves, even although the argument built on them, and the conclusions drawn from them, are true, musically speaking.

For example:

Writing in 1882, in "The Rules of Counterpoint",

W.S. Rockstro states that

"Counterpoint must be taught now exactly as it was taught in the Sixteenth Century... The rules are those, and those only, to which Palestrina, Victoria, Marenzio yielded their loving obedience...."

(1)

And yet, a few pages later, Rockstro writes

"It was the author's original intention to have illustrated the present treatise entirely with examples selected from the works of the Great Masters - but the difficulty of finding passages exactly adapted to illustrate the precise Rule falling under discussion was so great, that this plan was unavoidably subjected to considerable modification. Abundant quotations have been made from the works of Fux.... but the author has found it necessary to write a large number of additional examples...."

(11)

No wonder that R.O. Morris writes in 1922, in his "Contrapuntal Technique in the Sixteenth Century" that "the logical processes of Mr. Rockstro appear to have suffered an interruption", and points to the inconsistency of basing the teaching of counter-

(1) Introduction p.5.

(11) Ibid p.13.

point on rules which should have been evident in the work of the Sixteenth Century Composers, yet, this not being the case, of creating examples that do fit the rules. Morris poses a dilemma: Do we follow Byrd and Palestrina, or follow Rockstro and others? If the first, we must abandon the rules, if the second we must abandon the Sixteenth Century. But there is no real dilemma. For when Morris writes that the rules of counterpoint (meaning Fuxian counterpoint), are found to have no connection with musical composition as practised in the Sixteenth Century, he identifies the Sixteenth Century practice with a style of composition; and the rules, with a discipline, which undergoes modification according to the theorist, and is relative to the principles of musical thought prevailing at that time. If "p" stand for "Sixteenth Century Counterpoint", and "q" for "Fuxian counterpoint", it appears that Morris in his reference quoted, regards p as contrary to q and excludes the case of the conjoint truth of p and q; whereas it seems to the present writer that p and q are independant, and neither the truth or falsity of p determines the truth or falsity of q.

The real trouble is the traditional equating of q with p; and Twentieth Century musicians have in the main, realised that this is false - that

q is not identical with p. Nevertheless, on this false premiss, there has been built up a system of teaching counterpoint with a purport that is widespread in value and usefulness.

This is realised by Chas. W. Pearce, who in 1926 writes:

"It is a mistake to regard the present day practice of Student's Counterpoint as a now obsolete method of part-writing, peculiar to some particular age or school nor should it be censured for not teaching more than falls within its province."

(1)

and it is also realised by Morris. At first, in 1922, he writes -

"Many teachers of wisdom and experience may grant that the rules of counterpoint need revision, that in many details they bear no relation to the practice of the great Polyphonic school of composition, but they may say, why cannot they simply be amended where necessary. Why must you challenge the whole system? Why cannot you leave us our Canto Fermo and our Five Species?

The answer is that the Canto Fermo was, even in those days an obsolete survival. To set this before the student as the normal, and indeed the only possible method of writing counterpoint, is to paralyse his melodic invention at the outset, and also to give him and utterly false idea of musical history. As for the Five Species it needs a more skilled advocate than the present writer to find any plausible defence for them".

(11)

(1) "Student's Counterpoint" preface p.x.

(11) "Contrapuntal Technique" p.5.

The attitude of Morris at that time is: Either p or q; but later, in 1944, the following shows that he has come to realise that p and q are independent, and may thus exist together -

"My method is basically that of the 'Strict' practitioners; its guiding principle ... is that of one thing at a time".

He is careful to emphasise that this is not the only possible way of approaching the subject -

"But it is a sound method, and a tested method; and though it is also a laborious method, it is probably the safest one for the elementary student of average capacity."

(1)

And so Morris himself eventually finds a plausible defence for the Species, for they embody a sound pedagogical principle of teaching one thing at a time; they represent a tested method which has been in use for at least two centuries and have formed a part of the studies of composers such as Mozart, Haydn, Beethoven, Schubert and Brahms; and they form a safe method for the elementary student of average capacity. Beyond the elementary stage, their usefulness as a method of obtaining technique, declines, for at basis it is an artificial method, and an end in itself.

(1) "Introduction to Counterpoint" p.7.

Thus there are no logical grounds for discontinuing the Species approach to the teaching of counterpoint, for Species counterpoint is itself - it is not synonymous with Sixteenth Century Composition; and when the term "counterpoint" is used, it should be as a Summum Genum, with division into its several Differentia, including Sixteenth Century Composition, Species technique, and the others not considered here.

We may conclude this section by referring to the need for scientific weighing of evidence, (already mentioned on page 60,) when writers criticise the traditional method of teaching counterpoint, and who will in turn affect the criticisms of other writers; and when writers review published texts concerned with the teaching of counterpoint. (i) Consider for example, this criticism levelled against the Species counterpoint, over thirty years ago -

"Who invented these rules, goodness only knows; why they have been perpetuated, it passes the wit of man to explain.... 'Music that never was on sea or land.' "

(ii)

(i) See for example the review of Jeppesen's text "Counterpoint" in The Musical Times, December 1950; and Jeppesen's letter to the Editor, May 1951 and in which Jeppesen refers to statements made by the reviewer - statements proved false by a pointing to actual facts.

(ii) Morris, R.O. "Contrapuntal Technique" p.2.

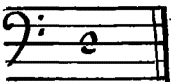
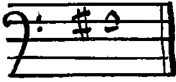
To-day, surely, that author realises that this style of criticism fails in objectivity; that the 'rules' have not been 'invented' - for a knowledge of an outline history of Contrapuntal Theory from Hucbald, d'Arezzo, Franco, through Tinctoris, Guilelmus, Vicentino, Nanini, Zarlino, Cerone, Barardi and others down to Fux, would show that the rules were crystallised from practice, and modified by time; that the rules have been perpetuated throughout the Eighteenth and Nineteenth Centuries through a mistaken loyalty to a tradition which had strayed from actual practice - not so difficult for the wit of man to explain when conditions were such that reference to the actual music of the Sixteenth Century was not common habit, due in part to comparative inaccessibility, and in part to a lack of incentive to apply Scientific Method to musical matters. And the quotation from Shakespeare is irrelevant.

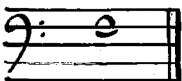
Thus logic could be applied, with benefit, to musical criticism and to musical pedagogy, both concerned with a reference to music by way of the verbal symbol; it remains now to examine the direct application of logical principles to the music itself.

SUB-SECTION B.

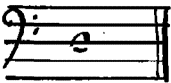
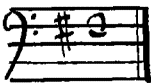
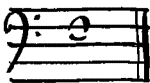
1. The Law of Contradiction: "x cannot both be and not be, A." If "x" stands for an interval, and "A" for

a particular quality of that interval, a verbal example in music becomes: A third above a root cannot both be and not be, major (i.e. cannot both be major and minor at the same time); a musical illustration becomes-

A third above  cannot both be 

and  at any one time. In harmony based on the triad, the third, whether major or minor, is an essential part of the chord; and being essential, if two thirds or more are used at any one time, these thirds will be subject to

2. The Law of Excluded Middle: "x" either is A or not A", so that the verbal example in music now becomes: A third above a root either is major or minor (using dichotomous division of the third's quality as it relates to diatonic harmonic resource, or modal resource). The musical example becomes -

A third above  either is  or 

Now, Induction by simple enumeration has for its logical form: All the observed S's are P's, therefore all S's are P's. The immediate musical example above could lead to the conclusion: Because that one F (the given third) is either major or minor, all the F's are either major or minor - or, more generally, because one third

If "p" stands for the soprano part, containing the minor third above the root; and if "q" stands for the alto part, containing the major third above the root; and if both p and q are satisfactory in relation to the bass (bass in the sense of lowest part), according to the prevailing norm of consonance-dissonance at that time, then the conclusion "r" is valid, and, in this case, true, because this particular extract is in the style prevailing at that time of musical composition.

Consider another example, the opening of the First Movement of Brahms' Symphony No. 3 in F, an opening which exhibits apparent inconsistency of quality of the third above the same root, and which Frank Howes describes as "a violation of logic for this period" - i.e. mid-Nineteenth Century. (1) In passing, the word "logic" in this context has no particularised meaning relevant to the inquiries pursued in this thesis - it is used as ordinary speech.



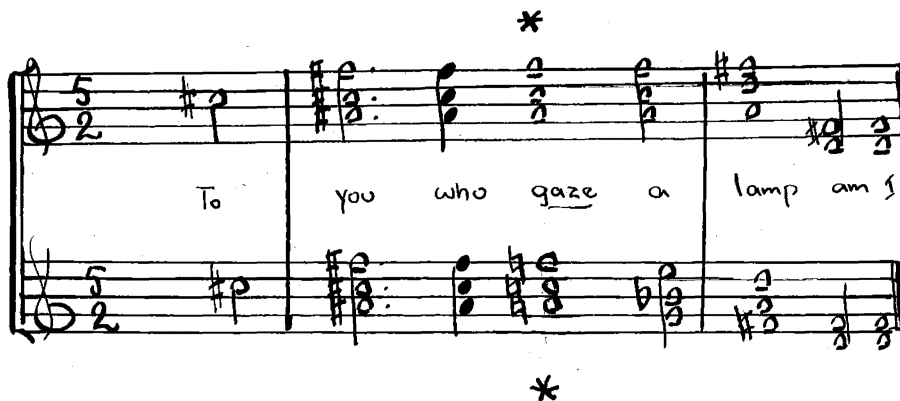
It is not a violation of "logic" considered contrapuntally according to Sixteenth and early Seventeenth Century practice; Brahms is merely writing in accordance with the premisses of this earlier style. Its "form" is a later example, chronologically, of the Weelkes - If p and q, then r.

Similarly, all vertical doubts in composition may be examined for acceptance or rejection on this syllogistic method of thought analysis, as stated by Chas. W. Pearce, and cited on page 54. Most likely, it is this principle of If p and q, then r, which is in the minds of authors when they use such phrases as "the logic of polyphony"; or "the logical progression of the parts " to justify apparent inconsistent combining of sounds, which, be it noted, are probably of a more dissonant nature than a consonant one. For example, consider these two examples of chordal part-writing -

Beethoven, op. 81 A.

The image shows a handwritten musical score for two staves. The top staff is in treble clef and the bottom staff is in bass clef. Both staves are in 4/4 time and have a key signature of two flats (B-flat and E-flat). The lyrics are written above the staves. The first staff has the lyrics "Le - be - wohl!" and "Le-be- wohl!". The second staff has the lyrics "Le - be - * * * * * wohl! Le-be- wohl!". There are several annotations in the score, including "3" and "2" written below the notes, and a large "X" written below the second staff. The notation is handwritten and appears to be a study or working draft.

Holst "Hymns of Jesus"



These examples can stand on purely musical grounds, and they can be explained according to logical principles, quite apart from the directing power of a programme (which they do in fact possess, because they portray the emotive character of certain words, as underlined in the examples), which we elected to disregard (see page 12).

This Principle of the Syllogism seems the most applicable to the music itself. It is of value in teaching musical composition, and in studying musical composition, particularly of a contrapuntal character. Thus, within its own limits, music as sound could illustrate a point of logic (page 55), and if a musician has an apparent need of logic, this applies to the composing musician, and the teaching musician, no less than the literary musician (page 56).

5. Finally, the Principle of Deduction (or Inference).

"If p implies q , and p is true, then q is true" has a

particular manifestation in canonic writing. If "p" is equivalent to "Canon in Diapason" and "q" is equivalent to the "Resolution", in a musical example it becomes -



and is a canon at the octave below, starting at #, it implies itself as resolution - i.e. q -



so that if p is true, musically speaking, then q also is true, because they are the same progression.

But this principle does not appear to be worthwhile in application to music.

+ + +

When Guido Adler prepared his table of Musical Science (quoted on page 15), he considered the following to contribute to the Systematic Section:

Acoustics and Mathematics;
Physiology (sensations of sound);
Psychology;
Logic;

etc.....

We support his opinion regarding the contribution of Logic, and have endeavoured to indicate its potentialities.

- CHAPTER SIX -

CONCLUSIONS

By the method of question and answer, the results of this inquiry may be tabulated and appraised.

+

1. As studies, what have Music and Logic in common?

- (a) A use of symbols, but this is not exclusive to them.
- (b) A small amount of shared terminology, but verbal similarity does not necessarily imply similarity of usage or referent.
- (c) The directing power of the intellect, but this is not exclusive to them alone.

CONCLUSION ONE: The dominance of mind, mentality or intellect, gives one grounds for considering music as a mode of thought, a way of thinking that is eligible for logic's consideration.

2. What parallels exist between Logic and Music?

- (a) The "Term" in logic finds a likeness in the "Single Sound".
- (b) The "Proposition" in logic finds a likeness in the "Melodic Progression".
- (c) The "Syllogism" in logic finds a likeness in the harmonic aspect resulting from combined melodies, progressions, or sounds.
- (d) Although logical "Inversion" finds no exact

parallel, the basic notion of changed relations finds a counterpart in music, which itself is called "Inversion".

CONCLUSION TWO: To a limited degree, inference exists in music, no less than in logic.

CONCLUSION THREE: Because of unlike substance, parallels between logic and music are acceptable only on grounds of analogy.

3. As a result of reasoning by analogy, what Logical Concepts are discernible in Music?

- (a) A melodic progression (i.e. proposition) can be true or false not in itself, but only in reference to certain norms prevailing in the various historical, stylistic and technical periods of music.
- (b) Combining of melodies (i.e. an equivalent to the syllogism) can be valid or invalid according to the referent norm of consonance-dissonance.

CONCLUSION FOUR: The plasticity of truth and validity, applied to music, is one evidence that music is a product of man's invention - man chooses the relations to be accepted. In logical thought, man cannot choose to accept what will be regarded true or valid in one century or point of time, and reject that choice at some other time, because certain laws and principles are independent of man's choice, they are perceived intuitively, and they hold for all time as guarantee of order.

CONCLUSION FIVE: The ideas of Truth and Validity are the particular contributions which logic has for music (see page 5, Introduction). The contributions are unique because music at its essence is temporal, and though being a product of man's fancy, imagination and inspiration, can yet find a common basis for comparison with the factualities of logic.

4. What concepts are conveyed by the use of the words "logic" and "logical" with reference to music as composition? (basing an opinion on customary usage) -

- (a) Consistency.
- (b) Coherence.

CONCLUSION SIX: It is probable that the majority of writers on music use the words "logic" and "logical" with the generalised sense of consistency and coherence uppermost in their minds, and with no wish to pursue an analogy with any particular logical procedure, although it was suggested on page 73 that the Principle of the Syllogism may have some appropriate application. In this sense, musical excerpts and works are held to be justified, although for some (writers and readers), the use of an intellectually-toned word is an easy way out of critical analysis.

5. Within limitations imposed by the analogy, what part of Logic may properly be applied to Music and Musical Literature?

- (a) Propositions and their relations.
- (b) The syllogistic method of thought-presentation and analysis.
- (c) Definition; Logical Division; Classification.
- (d) Methodology; Scientific Method.
- (e) Inference.
- (f) Judgments of Value.

CONCLUSION SEVEN: "Logic" in this inquiry is to be interpreted as Elementary and Traditional Logic - not Modern Generalised Logic.

6. What part of Music derives particular benefit from an acceptance of Logical procedure?

- (a) That part which employs verbal symbols about music i.e. history, criticism, pedagogy, philosophy of music.
- (b) That part of music itself which has a contrapuntal bias - see note (1) end of p.79.

CONCLUSION EIGHT: If music derives benefit from logic, musicians interpreted widely should derive benefit from logic. Therefore, apart from general advantage to them, it could be strongly recommended that Bachelor of Music students would receive particular benefit from taking an elementary course of logic as their Bachelor of Arts subject. The greatest, single advantage would be the acquiring of the means whereby objectivity supplants subjectivity - a difficult procedure in music, where one's immediate impression is personalised.

+ + +

He who chooses to employ the terminology of logic when referring to music, may do so fortuitously or designedly. If the former, the inherent nicety of Logic's method is in danger of being lost by a stretching into indeterminacy; if the latter, the contributory force of Logical procedure is deepened by being concentrated into specific instances. This deliberate usage is justifiable and defensible.

(1) Reference from previous page:

In the preface to his "Studies in Counterpoint", Krenek writes that with the disintegration of tonality in the Nineteenth Century, there arose the question: What new methods could be devised to create logically coherent forms in the atonal material? As tonality is basically harmonic, and atonality basically melodic, it appears that the Polyphonic conception of music in the Middle Ages - prior to the development of tonality - would provide the answer; thus Atonality and Twelve-Tone technique is to be approached by way of counterpoint.

This whole inquiry has not been without its interest, nor without value. There has been no aim to regard music as a proper province of Logic as ordinarily considered; no desire to cause re-orientation of Logic's subject matter; only an urge to point out the gain to music and musicians which can be recognised as resulting from an application of logic. The inquiry has shown that it is feasible to bring music into a relation with logic; that logic in music is independent of feeling and imagination; that in teaching composition, as prescribed say, in a University Course in Music, there are tangibles within the intangibles; and, finally, that the inability of music to argue, does not negate the implications of the title "Logic and Music".

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"Disquisitions on various branches of knowledge must evidently be as boundless as human knowledge itself, since there is no subject on which reasoning is not employed, and which, consequently Logic may not be applied; but error may lie in regarding everything as the proper province of Logic, to which in truth, it is merely applicable."

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