A STUDY OF ONE ASPECT OF PSYCHOPHYSIOLOGICAL RESEARCH AS IT RELATES TO THE EVALUATION OF SCHOOL MUSIC PROGRAMS

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ABSTRACT

There has been a lack of objective data in the affective domain concerning a S's responses to musical stimuli. Recent developments in psychophysiological research show that relationships between the affect of a particular stimulus situation and the concomitant changes in a S's autonomic nervous system are being defined in quantifiable terms. In this study 40 children, kindergarten to grade VI were presented with 6 different rhythmic (stimulus) patterns. While this was being done, the Ss' heart rates were monitored. Total HR was calculated for each 45 second stimulus period. These totals were used as a measure of the Ss' affective response to the rhythms. The response totals were rank ordered. The 40 Ss were grouped into grade/sex categories so that comparisons of response by grade/sex could be made. Responses to 2 of the rhythmic patterns received highest rankings from 11 of the 12 grade/sex categories identified for the study. There was little evidence of reinforcement or extinction of response for individual rhythmic patterns. Boys: K and II were identified as the best predictors of the total group response. These and other findings were compared with the previously stated opinions of 5 music educators with regard to what they

thought the study's findings were likely to be. Discrepencies between "expert" opinion and the actual findings of the study give support to the view that evaluation of music programs would show improvement with the increased use of objective data in the evaluative process.

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CHAPTER I

Introduction

Value oriented questions about education are being asked with increasing frequency. Education has become a costly item of public expense. Furthermore, in the face of the potential disaster resulting from a lack of such things as environmental control, it can no longer be assumed that education should be given top priority as the means by which quality of life is to be maintained. Value oriented questions about the general relevance of education lead inevitably to value oriented questions about the relevance of specific programs in education. It is not surprising therefore, that educators should feel a need to evaluate programs in their field of interest. For music educators the Tanglewood Symposium (1967) marked the beginning of a concerted effort to evaluate music programs.

The Problem

It is not enough that music educators accept the necessity for increased activity in the evaluation of music programs. They must also raise the question of what modes of evaluation are likely to be most efficient. Questions concerning efficiency imply that there are alternative

methods to be compared. There is a lack of alternative methods when it comes to evaluating programs in music education. For example, music educators, do not have at their disposal the wealth of objective data in the affective domain (the domain of prime concern to them), that is available to educators evaluating programs for subject fields in the cognitive domain.

It is therefore, the purpose of this study to generate objective data in the affective domain relevant to the evaluation of school music programs. The data is to take the form of a rank ordering of the affective responses (changes in HR) concomitant with the presentation of the stimuli (differing rhythmic patterns).

The need for such data in the evaluation of music programs in Manitoba becomes evident from a brief review of music curriculum developments for the Province. During the period that extended back from no more than 5 or 6 years ago, curriculum evaluation, by implication was thought to have been achieved largely through the process of rewriting a program already in existence. Justification for any alterations that were deemed necessary was based entirely on a consensus of the opinions of a small group of music supervisors with the addition of one or two music teachers. Since that time two events of some significance for curriculum development in music have taken place. First, several committees, one each for elementary, junior high and senior

high school music, have replaced the one committee that existed in the past. Second, a Fine Arts Curriculum Consultant was appointed for the province by the Department of Youth and Education (January, 1970). These two events have meant that the process of curriculum review has now become an on-going process and that the opinions of many more people will be taken into account in arriving at decisions effecting curriculum revision.

However, in one important regard, the process of curriculum revision is no different from what it has been in the past. The evaluation process itself has not been changed. The subjective opinions of music educators is still the sole basis for curriculum evaluation whether the evaluation is formative or summative. It would appear to be imperative that alternative bases for curriculum evaluation be investigated.

Fortunately the means for generating data that would provide an alternative to the subjective opinions of curriculum committee members is available. Recent developments in psychophysiology hold promise of producing objective data in the affective domain. With this in mind we now turn to a definition of psychophysiology and a comment on the relevance of psychophysiology to this study.

Psychophysiology: Definition, and Relevance to this Study

Ten years ago there was an almost total lack of

knowledge concerning the physiological changes inherent in a subject's reaction to affective stimulation (Lacey and Lacey, 1962). Although developments in the field are recent, it would be incorrect to assume a paucity of research data. Availability of sophisticated technology for research has done much to compensate for the earlier lack of activity in psychophysiological studies. Such studies, though recent in origin are receiving a great deal of attention at the moment. This being the case it would seem appropriate to define the term used to identify the field of activity covered by the studies.

Dr. John A. Stern (1964), gave the following definition for psychophysiology at the time when the journal "Psychophysiology" was initiated.

> I would like to offer as a working suggestion that any research in which the dependent variable is a physiological measure and the independent variable a "behavioral" one should be considered psychophysiological research.

Dr. Stern's prime concern in setting forth this definition was to make a distinction between physiological psychology and psychophysiology. Two reasons could be given for making the distinction. On the one hand the distinction identifies psychophysiology as being of recent origin, a point that could be missed by those who might equate the relatively long standing use of physiological measurement with psychophysiology.

A second reason for making the distinction is stated

by Dr. Stern in these words.

> Thus a distinction between psychophysiology and physiological psychology becomes immediately apparent. The latter deals with the manipulations of physiological variables and the recording of behavioral events while psychophysiology deals with the manipulation of behavioral events and the recording of physiological variables.

Interpretation of the distinction between physiological psychology and psychophysiology in terms of the present study follow. The presentation of differing rhythmic stimuli in a situation that requires a child to either attend to or reject them becomes the manipulation of behavioral events. Readings taken from a cardiotachometer (as was the case in this study), become the record of changes in one physiological variable. The relevance of psychophysiological research procedures to a study of children's affective responses to rhythmic stimuli therefore becomes apparent.

Organization of the Remainder of the Thesis

Chapter II is a review of the literature which deals with recent developments in curriculum evaluation and also developments in psychophysiology. An attempt has been made to delineate the problems that are uppermost in psychophysiological studies. In Chapter III materials that had to be prepared for the study are discussed, in conjunction with a brief explanation of the instruments used for gathering data. The sample, the testing procedure and the statistical treatments used are also discussed. Chapter IV is a presentation of the findings of the study, while Chapter V gives the summary and conclusions of the thesis.

CHAPTER II

REVIEW OF THE LITERATURE

To be seen in its proper perspective, the study should be viewed against the background of three topics of current interest. First, there is increasing evidence that writers concerned with education are raising value-oriented questions about the goals being set for our schools. Second, educators, and in this case music educators, are being urged to become conversant with a wider range of possible ways to realize the potential of any given course of studies. And third, research in the behavioral sciences is making more use of the sophisticated technology that is now available. The emergence of psychophysiology as a recognized discipline, holds promise of providing, in the affective realm, the wealth of objective measurements that are already available in the cognitive realm.

Value Oriented Questions About the Goals Set for our Schools

We live at a time when a resident of one of our large urban centres can remark, and not entirely in jest, that in order to convince the viewers of an evening weather report that the day has not only been free of rain, but has

actually been sunny, photos of the sun taken from a high-flying jet have to be shown. Our daily newspapers report on the latest figures giving the total, in tons, of the fish that have been destroyed because of mercury contamination. Damage to our environment is extensive. Repair will be costly. We can no longer expect to finance education costs from the surpluses of uncommitted money that we hoped might accrue from technological progress. Education has been forced to make its claim for the tax dollar, in competition with programs effecting our survival. It is in this context that questions are being raised about the values of our educational system. The questions are different from those asked in the past; just how different, may be seen from a brief survey of the kinds of questions that have been asked about education over the past several decades.

Taylor and Cowley (1970), have provided a survey of the significant changes in the kinds of questions that have been asked about the effectiveness of our schools, over a period that they have identified as being divided into three eras, the third being the present. A review of their survey is a useful preparation for an understanding of a current preoccupation with value oriented questions about our schools, and the goals that are set, or are being set, for them.

The Taylor and Cowley survey of the changes in the kinds of questions raised about our schools, is dealt with

in terms of changes in curriculum evaluation. They begin the survey with a reference to the period prior to the 1930's, when testing of content, instructional methods, sequencing of materials, took place in response to questions concerning methods.

A description of the work of Ralph Tyler and his associates, is the prime concern of the authors in identifying trends in curriculum evaluation during the second era. The Eight Year Study, to which Tyler contributed so extensively, set out five purposes of evaluation. These purposes covered such concerns as checking the effectiveness of an educational program and suggesting changes, validating operational hypotheses, providing information effecting study programs for students, adjudicating a school's accomplishments in relation to the goals it sets for itself and providing a sound basis for what we would now call "public relations" by indicating the value of the school program.

The five purposes of evaluation were to be met in terms of seven guidelines that were then formulated. Central to the setting up of the guidelines, was the emphasis placed on formulating objectives. Objectives were to be broadly based, encompassing both the needs of society as well as those of the students. What was known about the psychology of learning was to be taken into account. The objectives were to be pupil-oriented, with many of the

questions regarding objectives being phrased in terms of "What changes in behavior in the pupil do I expect to bring about in this lesson?"

Concomitant with the concern for statement of educational objectives as recognized in the Eight Year Study, was the work of such writers as Bloom and Krathwohl, who, in turn, dealt with objectives for the cognitive and affective domains.

The remaining six guidelines were identified for summary purposes, as: classifying objectives, defining them in terms of behavior, suggesting situations in which achievement of objectives will be shown, selecting and trying promising evaluation methods, developing and improving appraisal techniques, and interpreting results.

The point of significance in the recital of the accomplishments identified with the second era of curriculum evaluation was,

> its stress on stating objectives behaviorally and its lack of stress on valuing the objectives themselves. (Taylor and Cowley, 1970 c.)

It is this concern for the lack of evaluating the objectives themselves, that has marked advances in current writings on curriculum evaluation. Writers expressing a concern for evaluating the objectives themselves have been reinforced by the advent of government funding of curriculum projects, the desire from other funding agencies to see proof of results, the increased interest of educationists

themselves in curriculum development.

Taylor and Cowley pay particular attention to Scriven as being notable among those who raised the question of evaluation of objectives in his attempt to formulate a theory of curriculum evaluation.

Scriven is credited with differentiating between the goals and roles of evaluation. The goal of evaluation is revealed in questions dealing with the merit of education "instruments". The roles of validation include the uses to which the evaluations are to be put, as in making decisions to accept or reject a particular education instrument for a particular situation.

The distinction drawn between goals and roles lead to further clarification about the roles of evaluation. First it was argued that too many educators had chosen to deal with the roles of evaluation at the expense of goals. So long as the roles of evaluation were the object of concern, difficult value judgments could be avoided. Second, a distinction was made between formative and summative evaluation. Formative evaluation provides feedback for an educational enterprise. It is not particularly beholden to objective judgment. Summative evaluation obtains credence from objective judgment.

Scriven's greater contribution to the development of curriculum evaluation lay not so much in the clarity of debate he engendered in discussions of the subject, as in

his insistance that evaluation involved value judgment.

> Scriven demanded that evaluation procedures of any kind must include procedures for the evaluation of the goals themselves.
>
> (Taylor and Cowley, 1970 c.)

The urgency to evaluate the goals themselves, that is attributed to Scriven, is sustained in other writings of current educational interest. Taylor (1970 a.) in iterating the same theme, concludes a critique of evaluative behavior with the following.

> Before we go too far, before we start work within a set methodological framework, it would seem desirable to include more ways of looking at the meaning of goals, the semantics of objectives, the appropriateness of our measures and our judgements, and the evoking of value-biases.

We will not have to wait for the views of those who would challenge the goals, explicit or otherwise, that have been set up for our schools. Kaplan (1966) states the challenge in terms of the person, subsequent to a more general statement of propositions supporting the need for "the esthetic" as one part of a total view of life.

> These general propositions are equally valid and made more dramatic when they are applied to the person. The person whose life is whole or integrated is one who relates to the world about him in the fullest dimension. Not all of life consists of mathematical endeavors, as one figures his income tax; or of loyalties, as one salutes his flag; or of color sensitivity, as one selects his neckties. But these are common types of experiences, as we move from the objectively scientific to the traditionally assertive, and to the subjectively esthetic. Who is to say what is more important? That depends on whether the tie is being purchased, the flag is being saluted . . .

The goals that have been set for our schools were further

challenged by the Tanglewood Declaration. The Declaration was published following a symposium, (summer of 1967), held at Tanglewood, the summer home of the Boston Symphony Orchestra. Musicians, sociologists, scientists, labor leaders, educators, representatives of corporations, foundations and governments, and others concerned with the many facets of music, made a contribution to the framing of the Declaration. It read in part,

> We believe that education must have as major goals, the building of personal identity, and nurturing of creativity. Since the study of music can contribute much to these ends, we now call for music to be placed in the core of the school curriculum.

Broudy (1967), one of the contributors to the Symposium, joined with the others in support of the Declaration. However, his support could not be construed as an unqualified demand for more music in our schools whatever the result. Broudy made an important distinction between popular and serious art, between that which finds its justification in individual taste and that which looks to "cultivated taste" for judgment. For as he says

> There is no dearth of musical activity in the land, if one does not bother to differentiate among the activities.

Having made this distinction Broudy stated the case for aesthetic education in these terms,

> I would argue that aesthetic education should be part of everyone's schooling because systematic reflection extends the aesthetic experience, intensifies our interest in it, and enhances the enjoyment of it. Educated language usage and educated judgment and action

> in any domain are justified by the fact that they enlarge the range of whatever value is to be realized in that domain and the chances that we shall realize them. Furthermore, because mass engagement of the schools in the cultivation of taste entails a belief that such cultivation is possible as well as worthwhile, one has to show that an effective school program in aesthetic education can be devised.

A Challenge to Music Education

The Tanglewood Symposium gave to those who attended, a much needed forum to discuss basic issues about the role of music in our society. Why, for example, should music be taught in our schools at all? The answer interestingly enough was not always provided by the musician. Perhaps the reason for this was best expressed at a later date by one of the "non-musicians" who attended the Symposium. Broudy (1969), pointed out, that in his view, it was a mistake to "saddle scientists and artists with the task of the educator and the reformer".

> The exploration of these possibilities for life is the task for all of us insofar as we are cultivated human beings. Furnishing the contents and forms of thought that bring men to this state of cultivation is the first task of general education.

Whether or not we accept Broudy's "excuse" on behalf of the musician, we cannot ignore the point at issue. Serious questions about the role of music in society were raised at Tanglewood. And, although the questions began as a quest for answers to why music should be taught in our schools, the matter did not end there. Even while the speakers argued the case for music as a necessary part of

school programs, a challenge was extended to music educators to evaluate the music programs already in existence. The quality of music education had to be such that it could be worthy of support. The challenge appears to have been accepted. Numerous authors, most of whom are music educators, are expressing concern for what they consider to be a lack of one kind or another, in school music programs [eg. Rochberg (1968), Sanford (1969), Gaston (1969), Apicella and Giampa (1969), Di Rocco (1969)]. From their expressions of concern is coming the impetus for a renewed search for answers.

> Teachers of music are inevitably faced not only with determining the aesthetic experience but also with defining the aesthetic literacy level of a child, the nature and meaning of the aesthetic experience in music, and the pedagogical role involved in the aesthetics of music.
>
> (Di Rocco, 1969)

One possibility for a fruitful search for answers was suggested by Gaston (1969). He urged music educators "to follow the paths of the behavioral sciences". Studies reported in recent issues of the Journal of Research in Music Education are showing increasing evidence of an acceptance of Gaston's challenge.

Measurement techniques are being developed in the area of music appreciation (Crickmore, 1968, 1969). Children's music activity preferences are being subjected to statistical analysis, (MacGregor, 1969). Longitudinal studies into the Auditory Perception of Children, (Petzold,

1969), are being reported. A resume of some of the findings and conclusions of the last named study will serve to suggest the extent to which some of the research in music education is following the "paths" of the behavioral sciences. Children from elementary schools were the subjects.

Differences in auditory perception were clearly established. Girls appeared to be more perceptive in the auditory sense than boys; it could be because boys' attitudes to singing were often inhibitory. Differences according to age were statistically significant only between grades 1 to 3. A plateau seems to have been reached in grade 3. This may suggest a need for a greater change of emphasis in the music program at the grade 3 level, that requires the children to attempt more challenging musical tasks. With respect to response to melodic items three stages of development were noted. Non melodic responses declined in grade 2. Greater vocal control was reported for the same grade. In grades 4-5, there was an increase in the number of partially correct responses that indicated awareness of more than contour and number of tones in a melody. The third stage in development of melodic acuity was made evident by the gradual elimination of incorrect responses. Of particular interest in the study was the finding that ability to learn a musical phrase could not be related to the accuracy with which children responded to short melodic items. The conclusion drawn from this finding suggested that

the ability to imitate aural presentation of certain kinds of musical ideas was not a measure of the understanding children had of those ideas. Also of interest was the conclusion that children will respond to that which they are asked to respond to, even in complex auditory situations. Treating each element of a song-phrase as a separate entity may not be an efficient teaching procedure in the presentation of a rote song.

The resume of Petzold's study has been given as evidence that music educators are beginning to look beyond the limits of subjective judgment for answers to questions that have been raised concerning music education. Suggestions for further development in the use of the behavioral sciences for music education research, are given in the following extract from a report on research in Scandanavia. The report was given at an international seminar on music education research.

> The two topics of this paper have to do with the future of the psychology of music and the experimental research in music education. Extensive reading in the field has given the author some depressing experiences. Much research has been done by psychologists with little knowledge of music or by musicologists with little knowledge of experimental work (statistics is not enough to characterize an experiment). From this fact at least two tasks may be deduced: (a) to write a psychology of music, which considers all possibilities of psychology and with close relations to the musician's practical work with music: and, (b) to form a research team consisting of both musicologists and experimental psychologists. A team such as this was formed in Scandanavia.
>
> (Jensen, 1969)

We have then, a climate of general concern about the need for

aesthetic education in our schools. There is a concomitant awakening of the need for greatly increased research in the field. It is in this climate that we turn with interest to a field of study that holds promise for the advancement of music education research.

Psychophysiology

Evidence of research in music education is encouraging. Much remains to be done. There is an enormous lack of data concerning the affective domain, as compared to the data that has been accumulated from measurements taken in the cognitive domain. And it is the affective domain that is of particular interest to the music educator. While it is likely that part of the failure to collect data in the affective realm can be attributed to biases against the application of measurement techniques in a field that is recognized as being highly subjective by nature; it should be pointed out that the failure could also stem in part from a lack of awareness of measurement techniques that are available and appropriate. All the more reason then, why particular attention should be drawn to psychophysiology, one of the disciplines of the behavioral sciences that is both recent in origin and that is potentially fruitful in the wealth of data it could provide concerning the affective realm.

A review of the literature on psychophysiology

pertinent to the present study, that is, a review of the research that has looked for significant relationships between affective stimuli (auditory in this case), and heart rate changes, is confined almost exclusively to publications of the last half dozen years. This is due in part to the recent origin of the journal, Psychophysiology (Vol. 1, number 1, July 1964). Two events of interest pre-date the advent of the journal. The first concerns a report (Bronshtein and Petrova, 1952) or research into the affective response of neonates to auditory stimulus. Changes in sucking rate were related to the presentation of auditory stimulus in an attempt to generate data helpful to the description of the nervous system of neonates and infants. Later in the same decade, the Laceys (1958) presented findings based on various measures of spontaneous activity. Included among the measures was change in heart rate (HR). Initially the measures of HR change were applied to determining relationships between changes in HR and performance on a task said to measure motor impulsivity. Later, (1963) the Laceys extended their research to include studies of HR change in subjects (Ss), when the Ss were presented with auditory and visual stimuli. It was reported at that time that:

> cardiac deceleration typically accompanies attention to auditory and visual stimulation in adults and Kagan and Rosman (1964) have verified this association with first grade children.
>
> (Kagan and Lewis, 1965)

A new field had been opened. The search had begun for meaningful relationships between the physiological changes governed by the autonomic nervous system and a S's proximity to auditory or visual stimuli. The search for those relationships, particularly as they pertained to HR changes in the presence of auditory stimuli, resulted in outcomes that tended to point to further research. Most of the relationships that have been "discovered" to date remain open to possible change in the light of further findings. Following is a brief survey of some of the issues that have arisen as a result of recent studies of HR changes.

There is the controversy between the Laceys' findings, (1963), and the findings of other researchers concerning the circumstances that typically produce either HR acceleration or deceleration. There will be some difficulty in resolving the controversy. At least five variables effecting HR changes have been identified to date.

Sinus arrhythmia, the change in HR relative to the respiratory cycle is one of the variables. It has been dismissed by some researchers as being of little consequence to the findings of their study, (Hnatiow and Lang, 1965). In another study of a similar nature, the opposite view was expressed, (Brener and Hothersall, 1966).

The relevance of the Law of Initial Values (LIV), stated first by Wilder in 1931 (Hord, Johnson, Lubin, 1964), has been identified as another variable.

> Given a standard dose of stimulus and a standard period of measurement, the response, defined as the change from the original (pre-stimulus) level, will tend to be smaller when the initial value is higher. This would be the case for function-raising stimuli. For function-depressing or function-inhibiting stimuli the negative correlation becomes positive.
>
> (Hord, Johnson, Lubin, 1964)

Attempts have been made to offset, through statistical control, the effects identified by the Law of Initial Values. General agreement about the appropriateness of such control has not been reached.

The psychological "set" of the subject has been identified as a third variable that has to be accounted for in defining the circumstances that produce HR change. Hord, Lubin, and Johnson (1966), recorded somewhat different results in HR changes, for field independent Ss as compared to field dependent Ss. It was argued that the differences were probably related to somewhat different, inter-related functionings of the sympathetic and para-sympathetic components of the autonomic nervous system, for each of the two types of individuals.

Roessler, Collins, and Burch, 1969, reviewed reports on the effects of attempts to verbalize. They noted the findings of Campos and Johnson, 1966, 1967.

> They concluded that instructions to verbalize produce acceleration in response to a variety of stimuli, while the absence of such a requirement with the same stimuli resulted in HR deceleration.

Reference was then made to Wiener (1962), who had previously emphasized the acceleration effects of the verbalization

requirement.

Add to all the above variables, the complexity of the stimulus situations that are attendant upon studies of HR changes and it is understandable that there continues to be a divergence of opinion about the significance of the changes. In spite of this divergence of opinion, some measure of agreement on the meaning of HR changes may not be too far from realization. Edwards and Alsip (1969), accepted the position taken by the Laceys as the basis for the interpretation of the results of their study. The study was to a large extent a summary of previous research findings on HR changes.

> The Laceys demonstrated that cardiac deceleration . . . accompany the environmental intake tasks, and that acceleration . . . accompany the environmental rejection tasks.

And further that:

> Lacey et al (1963), suggested that the intake-rejection tasks were not dichotomous but ordered themselves along a continuum.
>
> (Edwards and Alsip, 1969)

As well, Edwards and Alsip took into account findings of Johnson and Compos, (1967), regarding the effects of verbalization. In summary they tentatively ordered the expected magnitude of HR response according to the following.

> A non-verbal condition produces less of a cardiac increase than a later verbalization requirement which in turn yields a lesser cardiac acceleration than concurrent verbalization. In a similar manner, it might be expected that a complex intake task should effect a greater cardiac deceleration.

Roessler, Collins, and Burch (1969) did not directly refute the position taken by the Laceys as reported by Edwards and Alsip. They did, however, introduce a new dimension to the acceleration-deceleration controversy.

> Many of the studies showing accelerative HR responses have employed auditory stimuli. It is possible, as Graham and Clifton point out, that this type of response is modality specific. They noted that the only two studies in which other sensory modalities were stimulated failed to show significant acceleratory effects.

It would seem then, that HR responses to stimuli are likely to be deceleratory in nature except in the case of auditory stimuli.

Much research into changes in HR, has been devoted to establishing the relationships between the observed changes and the concomitant stimulus situations. Other research has focussed on the problem of whether or not HR can be controlled through some form of conditioning. The resolution of this argument would make a substantial contribution to our understanding of the autonomic nervous system generally. Those who contended that HR can be brought under control, found support for a theory that the principal discriminator between "voluntary or involuntary behaviors was the availability of specific feedback from the muscle systems in question," (Brener and Hothersall, 1966).

Riege and Peacock (1968), add a cautionary note as a result of observing that humans;

> show conditioned deceleration of HR when they sustain part of the respiratory cycle during an extended post-decision period, but that they cannot do so when they breathe normally.

Some control for breathing during cardiac conditioning studies seemed to be called for.

Whether the research into HR changes has been devoted to resolving the acceleration-deceleration controversy, or whether it has had as its focus, the study of HR conditioning, scoring HR has entered into the interpretation of the results. There is as yet a lack of conformity in scoring procedures. Roessler, Collins, and Burch, (1969), have identified five different methods in their study. Campos and Johnson are reported as having averaged HR over 15 second intervals for 1 minute of both pre and post-stimulus periods. Lang and Hnatiow (1962), calculated the difference between the fastest rate in the first 5 beats after stimulus onset and the slowest rate in the subsequent 15 beats. Johnson and Lubin (1967) used a modification of the Lang and Hnatiow method. Dykman's group (Galbecht and Dykman, 1967), subtracted the beat having the fastest HR in the 5 seconds preceding stimulus onset from the beat having the fastest rate during a 5 second stimulus. Roessler, Collins, and Burch had used four different scores, all of which were based on a beat-by-beat analysis of HR response to stimulus.

Of the other methods of scoring that have been

employed, perhaps one of the most promising was that devised by Opton, Rankin, and Lazarus (1965). Their method of "peak rate" was developed in response to some of the problems posed by the method of mean cyclic maxima, as developed by Maelstrom, Opton, and Lazarus. The method of mean cyclic maxima, involved the time consuming process of scoring HR for each beat-to-beat interval which was both preceded and succeeded by longer intervals. The HR for these beats was then averaged over 10 second intervals, to yield a mean cyclic maximum for each period. The peak rate method selected the beat having the single fastest rate within a given time interval. The saving in time was considerable. The single fastest beat proved to be about as good a measure of HR differential as the method of mean cyclic maxima. That is, the peak rate, and the mean cyclic maxima methods produced "equally high correlations with a standard measure of psychological stress," (Opton, Rankin, and Lazarus, 1965). Furthermore the peak rate method 'rode with' the cyclic variation due to sinus arrhythmia and avoided "introducing a large irrelevant variance into the data." (Opton et al, 1965).

Finally, a comment on a method devised by Lewis and Spalding (1967), because it represents a significant departure from the others. Lewis and Spalding computed separately, the median of the 12 first, second, third . . . r - r intervals following onset of stimulus presentation.

> The curves generated by this summing technique represent a biological time scale, that is, they represent the number of r - r intervals from a given point in time rather than the average rate in a given time period.

The advantage of this approach was that it allowed for a detailed study of each small cardiac change, whereas such changes might have been lost in averaging beat-to-beat changes over time.

The lack of conformity in scoring techniques for measurement of HR, is evident from the foregoing review. In the literature, attention was frequently drawn to the extent to which this lack of conformity contributed to difficulty in making valid comparisons between studies using different scoring techniques. At the same time, the differences in technique do not seem to have been a serious drawback to continuation of studies into changes in HR (Galbecht and Dykman, 1965).

Summary of the Review of Literature

The review of literature has covered three topics relevant to the current study. First, a survey of contemporary writings on curriculum, revealed a recent shift from a concern for the evaluation of instructional techniques to a concern for the evaluation of instructional goals.

Second, a review was undertaken of the literature that argued for the value of aesthetic education in our schools. Those arguing for the value of aesthetic education made an important stipulation. It was noted that, not all

school programs identified with the aesthetic necessarily contributed to a child's aesthetic development. Educators were charged with the responsibility to evaluate programs in the aesthetic realm. By inference music educators were going to have to evaluate their programs and make changes in accord with these evaluations. Furthermore, music educators were urged to utilize appropriate strategies from disciplines outside music education itself in the evaluative process. Particular mention was made of the possible benefit accruing from a greater use of the behavioral sciences.

Finally, developments in psychophysiology apposite to the study were reviewed. Although many of the findings reported in the review were equivocal, there was sufficient evidence of progress in psychophysiological research to warrant continued interest in the field. Significant relationships are being discovered between autonomic responses and affective stimuli. Refinement in the definition of these relationships, in conjunction with refinement in monitoring and scoring techniques, will provide increasingly reliable measurements in the affective realm.

CHAPTER III

THE MATERIALS, THE SAMPLE, AND THE PROCEDURE USED

In this chapter the preparation of materials, selection of the sample, and the procedure used, are described in detail sufficient to make replication of the study possible. A resume of the statistical treatment given to the data concludes the chapter.

Preparation of Materials: Equipment

The initial step in the preparation of materials was the selection of appropriate stimuli. To be appropriate, the stimuli had to satisfy two conditions. They had to be sufficiently restricted in form for the responses to the stimuli to be readily interperable. They had to be relevant to some aspects of elementary school music if the data to be gathered on the basis of the responses to the stimuli were going to lead to conclusions useful in the evaluation of school music programs.

In conformity with the first condition, it was decided to use as the stimuli, rhythmic patterns that were to be played on a concert snare drum, 6 1/2" deep x 14" diameter with plastic batter head. The particular patterns to be used, Figure 1, page 28, were selected in conformity

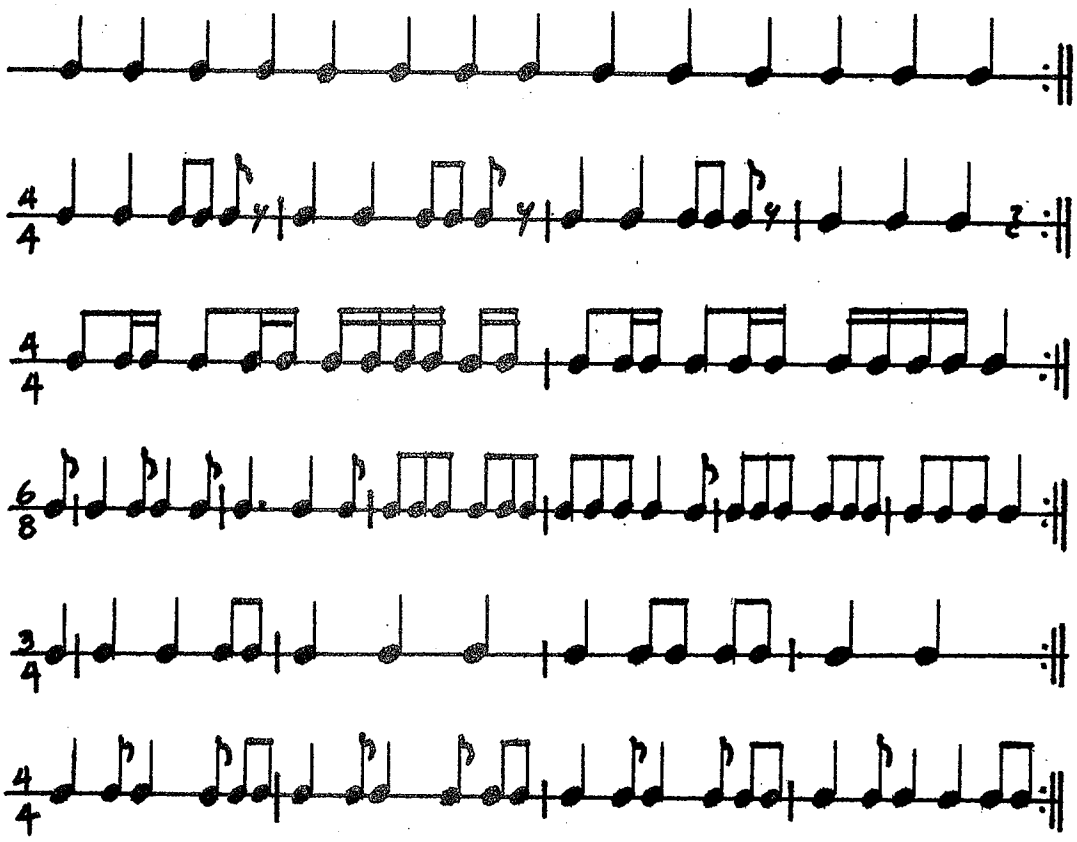

FIGURE 1. Patterns played in producing the six rhythmic stimuli.

(i) The patterns were played repeatedly over a period of 45 seconds.

(ii) The tempo was held constant for all patterns. (1 beat = 126 whether simple or compound).

(iii) The indicator on the record-level meter peaked at between a reading of 60-70 during the recording of the patterns. A reading of 100 was maximum for distortion free recording, (Ampex tape recorder model 602).

with the second condition. A review of song material listed in the Music Curriculum I-VI (Manitoba) was undertaken. Five rhythmic patterns representative of many of the rhythms of those songs were selected to be stimulus patterns 2-6. Stimulus pattern 1 was selected because it was basic to all the others. As well as being representative rhythmically, of grades I-VI (Manitoba) song materials, the patterns were also selected because they were thought to represent the range of rhythmic experience suitable for children in the elementary school. Examination of the selected patterns by musicians* qualified to express an expert opinion on the matter confirmed that the patterns varied in difficulty, and that they covered a range from easy to difficult insofar as children ages 5-12 were concerned. Each of the experts had ranked the 6 rhythmic patterns from easy to difficult. The rank order of P.1 (easy), P.5, P.2, P.4, P.3 and P.6 (difficult) was the preferred ranking. The lowest r_s correlation coefficient for alternative rankings was .94 (r_s = .829 at the .05 level of significance).

Once the choice of stimuli had been decided upon a master tape had to be prepared. The signals to be recorded on the master tape were the six different rhythmic patterns

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*further reference is made on page 41 to the "experts" who were consulted for this study. Their names are given at that time.

(stimuli) that were later to be played to the Ss. Although it was possible to maintain a constant tempo of m = 126 for all patterns, it was more difficult to adhere to a constant recording level, largely because of the percussive nature of the sound being recorded. A reasonable conformity was maintained between peak sounds for each of the patterns. (The sound level meter "peaked" at between 60 and 70 on the Ampex tape recorder model 602). The patterns were recorded in circumstances consistent with the acoustic properties of an average classroom.

The patterns recorded on the master tape then had to be transferred to cassettes. This procedure allowed for editing of the signals as well as for randomization of the order in which the signals were to be presented to each S. The cassettes to which the transfer of the signals were made, will be referred to as the stimulus tapes from here on. Ten stimulus tapes were produced with the transfer from master to stimulus tape being done via a direct connection between Ampex output to a Sony T C 130 cassette recorder input. The order for the presentation of the six patterns on each of the tapes was randomized by referring to a table of random numbers. Duration time for the signals was determined empirically from trials performed with neighborhood children. Each signal was edited to a forty-five second duration. A fifteen second interval (blank) was left between signals. In order to reduce startle effect a bell tone,

similar to the sound of door chimes, was recorded five seconds in advance of the onset of each signal. Since the study was concerned with possible differentiation of affective response to somewhat prolonged stimuli, hand switching in the transfer of signal from master to stimulus tape was deemed adequate. Ninety minute cassettes were used. Mention is made of this item since it had been intended to use 120 minute cassettes. The 120 minute cassettes were a poor choice. The film is so thin that it stretches and is prone to accidental winding around the recorder drive shaft.

After the stimulus tapes had been prepared one of them was played for the "experts" to be judged on the basis of whether or not reproduction of the rhythmic patterns was technically and musically adequate. The experts listened to the tape while they looked at the rhythmic patterns (Figure 1, page 28). They agreed that what they heard was a faithful reproduction of the patterns shown in Figure 1. By "faithful reproduction" they meant that: the timing of the drum beats was accurate, the quality of the sound of the drumming was of a clarity sufficient to contribute to the rhythmic definition of the notes, the volume of the drumming was within the range of being clearly audible without being uncomfortably loud or noxious. The experts found the quality of the sound to be uninteresting. They also felt there was a lack of clearly defined accent. Special mention of this

lack of accent was made in reference to pattern 5. (It is likely that the automatic gain control in the Sony T C 130 tape recorder had the effect of "levelling off" the accents at the time when the recorded rhythms were transferred from master-tape to the cassettes).

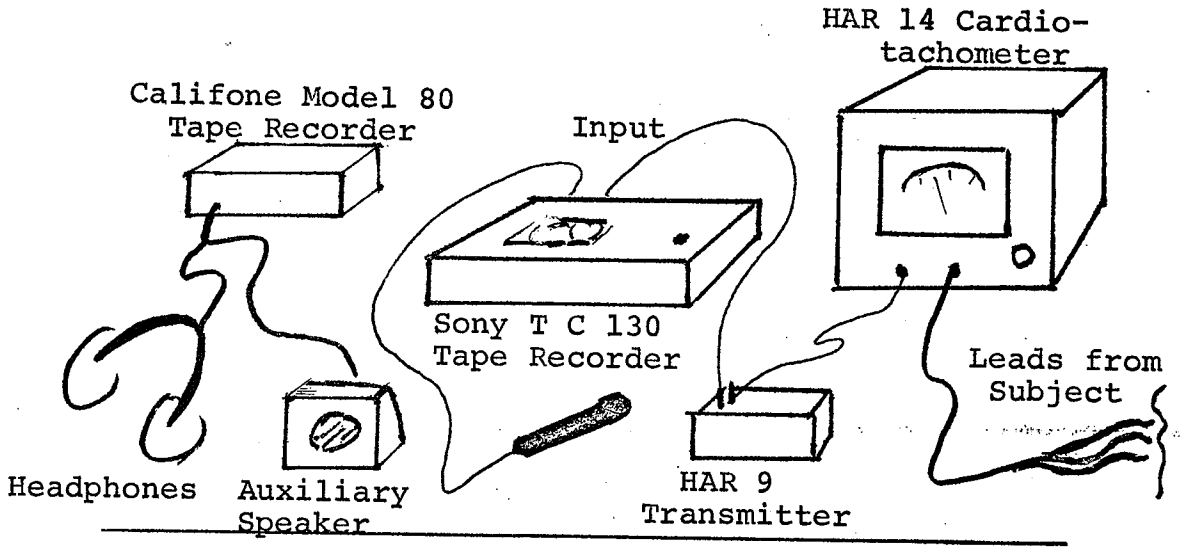
Mention will be made here of a second set of tapes that were prepared. Three contrasting musical excerpts were selected for presentation to the S's following the playing of the rhythmic patterns. This was done in anticipation of future studies. Since the results of this treatment have no immediate bearing on the present study, further mention of the treatment has been omitted.

A description of the equipment required for the study has been organized according to use. Equipment used in the presentation of the stimulus to each subject included a Califone, Model 80, cassette tape recorder, and headphones that completely enveloped the ears. The lead from the external speaker outlet was branched to accomodate both the head phones and an auxiliary speaker. There was no reduction of signal as a result.

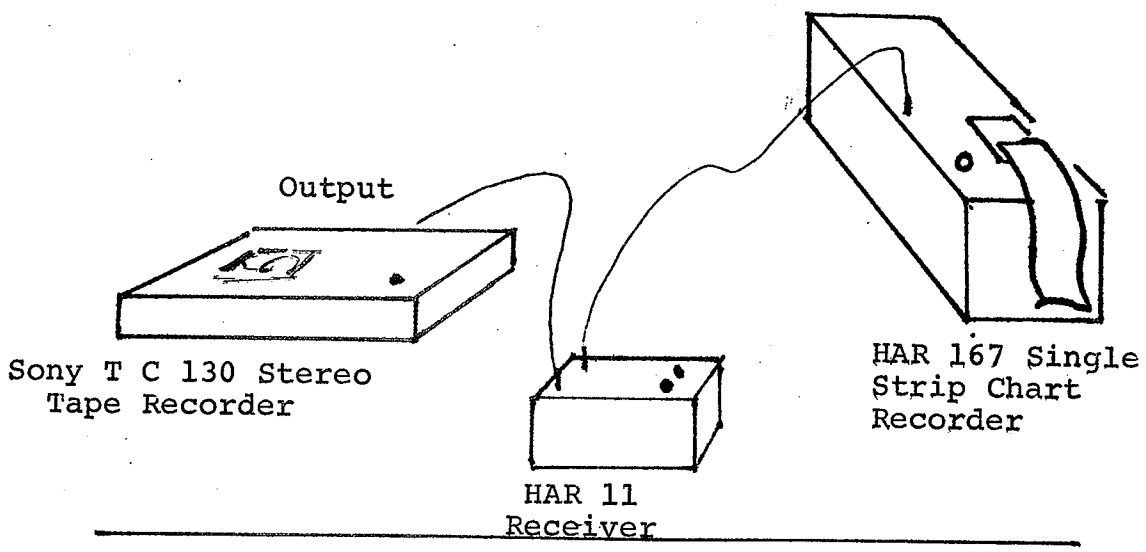
The prime instrument for data gathering was a HAR 14 cardiotachometer (Figure 2, page 33) to be referred to as the monitor. Appropriate leads with accompanying electrodes were included. Special adhesives for attaching electrodes to the wrists, a soft rubber strap for fixing an electrode to the right ankle, and a commercially prepared

(a) Stimulus Broadcast

(b) Response Reception and Recording



(c) Transcription of Response Intelligence from Audio Tape to ECG Strip Chart



*Equipment identified by "HAR" available from Harco Electronics, Winnipeg, Manitoba.

FIGURE 2. Equipment*

electroconductive cream were used to insure adequate contact between electrodes and S. A HAR 9 transmitter accompanied the monitor. A second cassette tape recorder (Sony, model T C 130) with microphone completed the equipment used in data gathering. Ninety minute cassettes were used thoughout.

Transcribing the intelligence stored on the cassette required the following equipment (Figure 2); the Sony cassette recorder previously used, a HAR 18 receiver and a HAR 167 single strip chart recorder. A clear plastic template 75 mm. in length, with hair line guides at either end was made for use in calculating heart rate (HR) from the electrocardiogram (ECG) tracings.

The Sample

The total sample consisted of 46 elementary school children from Agassiz Drive School, Fort Garry. There were four groups of ten selected from each of kindergarten, grades two, four and six. The remaining six children made up a control group of three boys and three girls. Two boys in the control group were from grade 5 and one from grade 6. The girls were from grade 5. In every instance the age of the children was appropriate to the grade they were in. The selection of the sample was confined to those children who had received permission from their parents to take part in the experiment. Names were drawn from among those receiving permission. Choice was limited since there were often no

more than seven or eight available candidates for each of the grade/sex categories. No strictures of intelligence or background were placed upon selection of the sample.

Procedures for Collecting the Data

A room where the monitoring of the Ss was to be done was provided by the school. Possible inadequacies in this arrangement were more than compensated for by the convenience afforded the children. The room provided was approximately 10 feet by 10 feet and was normally used by the school nurse. A roll-away cot, a chair and table, and a wash stand were the only furniture in the room. One third of the cot was raised to place the S in a reclining position so that the S could look at the electrodes without straining. The drum used in preparing the rhythmic patterns was on display.

Appointments were scheduled on half hour intervals from March 12, 1970 to March 23, 1970 both days inclusive. At the time Ss were given their appointments the girls were asked to come dressed in slacks and socks in place of the usual skirts and leotards since the ground electrode was to be attached to the right ankle. Arrangements made through the appointments were confirmed by the classroom teachers, and necessary adjustments were made.

Preparation of the Ss for monitoring began by fixing the electrodes to the inside of each wrist and around the right ankle. Ss were assured that they would not be hurt.

They were told that fastening the electrodes in place would be like having band-aids applied. The small children often took part in snapping the leads to the electrodes. Comments were made to the effect that the Ss looked like astronauts. This appeared to please them and induced them to settle back on the cot, ready for "blast-off". The Ss were then advised of what was to occur. Particular attention was drawn to the drum on which the rhythmic patterns had been played. It was suggested that they might listen for the drum beats they would most like to play. The headphones were put in place and adjusted for comfort. No further attempts were made to settle the Ss or to provide for time for the heart to settle to a basal HR. The foregoing procedures took approximately 6-8 minutes. Avoidance of restless behavior was of greater concern to this study than establishing a basal HR.

The monitor was switched on and the proper adjustment for sensitivity made. Recording equipment was switched on. Monitoring and recording of the HR had begun.

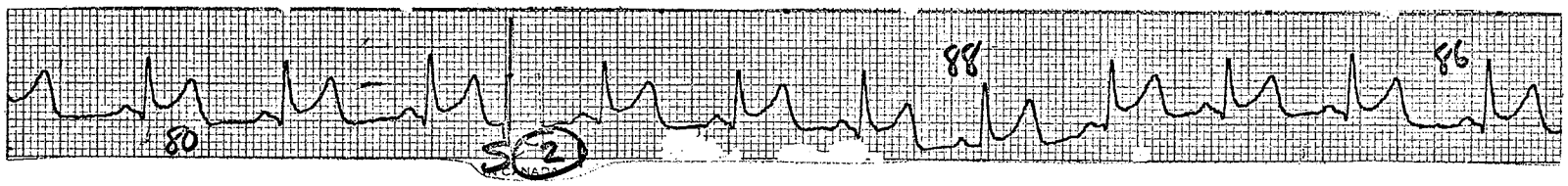
At this point the stimulus tape was switched on. The stimulus tape being used for each S had been pre-selected on the basis of a random selection within each grade level category of Ss (K, II, IV and VI). Once the stimulus tape had been switched on, intelligence from 3 sources was being stored simultaneously on the Sony T C 130 stereo tape recorder: the intelligence for an electrocardiogram (ECG), the stimulus as broadcast from a speaker that was paired with

the headphones used by the Ss, and spoken comments by E. The ECG intelligence was stored on one track of the Sony stereo recorder, and the stimulus signal plus E's comments were stored on the other. Total monitoring time was about 10 minutes.

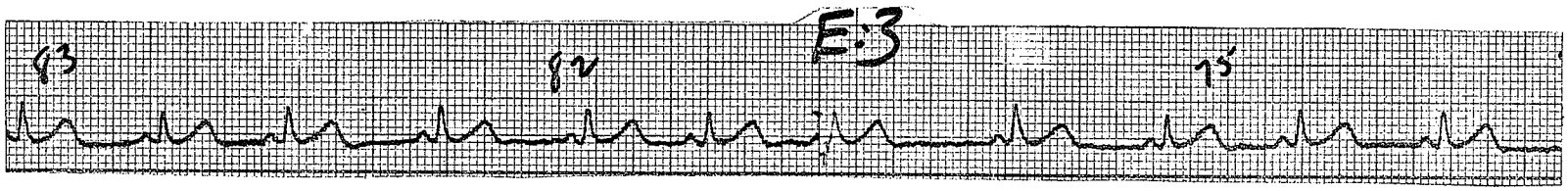
Transcription of the ECG-stimulus recording took the form of an ECG tracing done on a HAR 167 single strip chart recorder (Figure 3, page 38). The write-out rate was set at 25 mm. per second. The positioning of the tracing was adjusted so that one tracing could be made on the top half of the chart and a second tracing made on the bottom. A HAR 11 Receiver was put in the line between the tape recorder and chart recorder so that the HR intelligence could be de-modulated to the same frequency maintained by the monitor at output. Onset and termination (Figure 3) of the stimuli was coordinated with the HR write-out by switching both recorders at each of these events. The momentary uncontrolled vibration of the pen provided identification of these events on the strip chart.

Calculation of HR was done by hand. HR was calculated on the average rate for each three second interval (Figure 4, page 39), from the time fifteen seconds prior to the onset of the first episode of recorded drum beats, through to the termination of the fifteen second interval following the sixth episode of recorded drum beats. The previously mentioned plastic template was used to speed up estimation

Subject No. 18



Subject No. 24



Subject No. 35

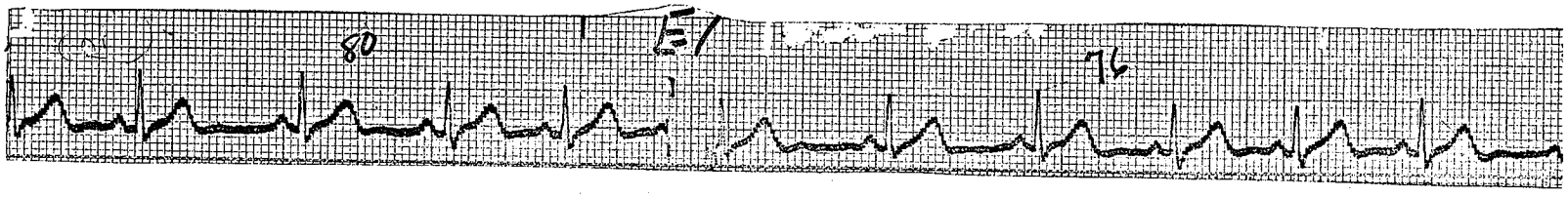


FIGURE 3. Heart rate tracings from subjects illustrating (i) changes in rate with onset or termination of rhythmic signal (ii) the uncontrolled movement of the pen used to identify each of the two events (iii) variations in tracings from subject to subject.

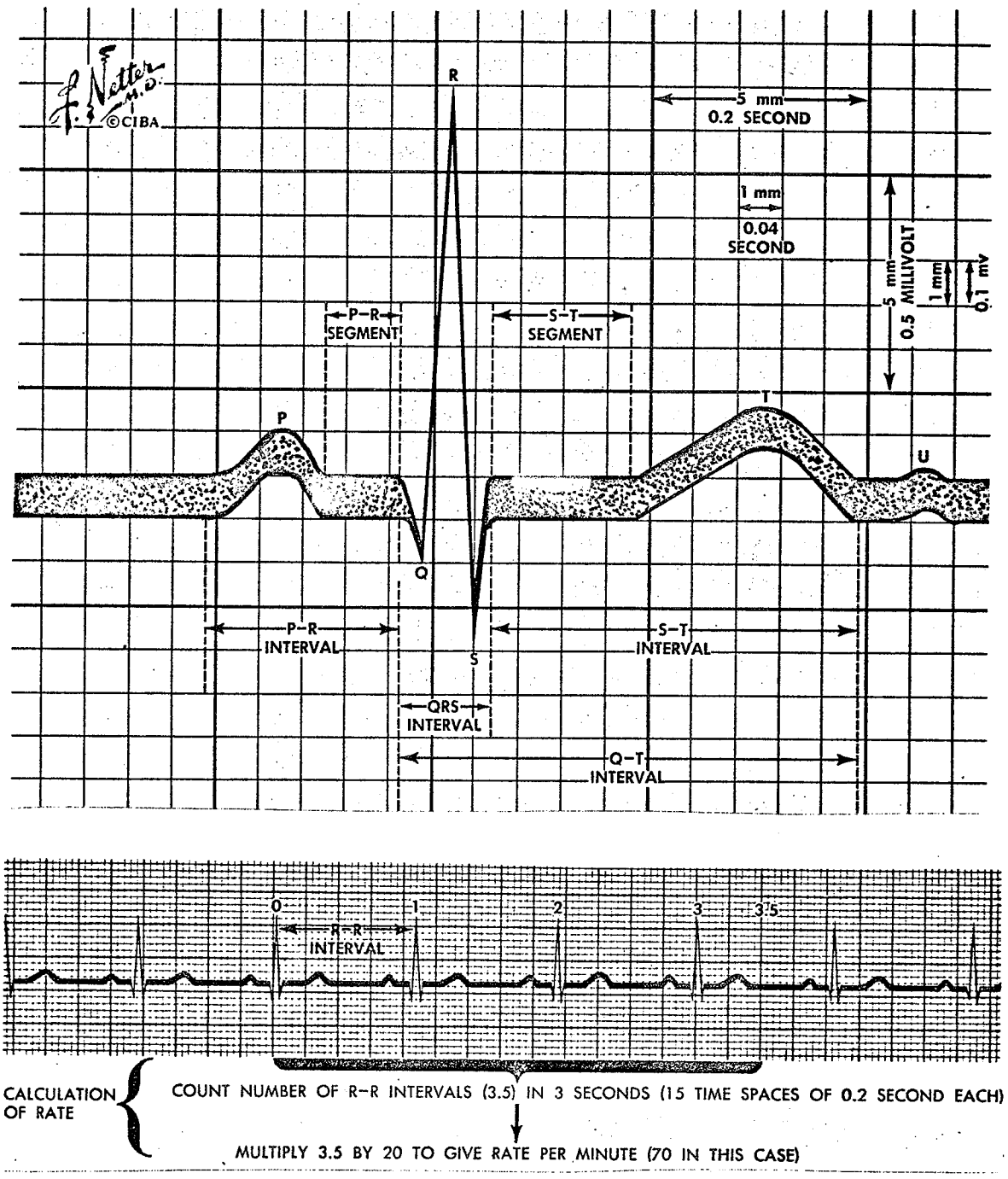


FIGURE 4. The electrocardiographic tracing and calculation of heart rate (Netter, 1969).

of fractional parts of a heart beat falling within the three second (or 75 mm.) limits. Estimation was made to tenths of a beat. To give added reliability to the calculation of the HR the peak of either an R or a T wave was used as a terminal point, whichever was nearest to either end of the three second interval being rated.

Statistical treatment of the study was based on the compilation of the data found in Appendix 1, page 71. HR totals were calculated for each 15 second interval from the time 15 seconds prior to onset of stimulus 1 to the conclusion of the 15 seconds following stimulus 6. (Totals for the pre and post stimulus intervals have been omitted from Appendix 1). Once HR totals had been calculated for the 15 second intervals as monitored, these totals were entered in the table, Appendix I according to rhythmic pattern as listed in the table. Comparisons between the total HR responses to each of the 6 rhythms could then be made more conveniently.

Totals for the 6 rhythmic patterns were rank ordered for each of the 40 Ss. The rank orderings were entered in Table I, page 46.

Further statistical treatment involved comparisons of the rank orderings of HR totals (in response to the 6 rhythmic patterns), for each of several categories of students.

CHAPTER IV

THE FINDINGS OF THE STUDY

Opinions of 5 Music Educators

The findings of the study are reported in relation to five topics. First there were the opinions of 5 music educators* given in response to many of the same questions that gave rise to the implementation of this study. The educators, (to be referred to as the "experts") were asked whether they thought it likely that children would be stimulated physiologically when they were presented with the auditory stimuli that had been prepared for the study. In the event that a reaction to the stimuli took place would the experts expect differences in response, relative to difference in sex or age? What kinds of differences would they expect? It was important to the study to include the opinions of experts in response to these kinds of questions because the opinions represented the only kind of data that

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*Dr. Peggie Sampson, Associate Professor, School of Music; Herbert Belyea, Associate Professor (music) Faculty of Education; J. P. Redekopp, Assistant Professor (music) Faculty of Education; all of the University of Manitoba. Also Glen Harrison, Music Supervisor, Seven Oaks S. D., and Alan Janzen, Fine Arts Consultant, Department of Youth and Education, Province of Manitoba.

is often available to curriculum planners. The opinions also provided points of comparison for any objective data generated by the study.

When the experts were asked whether they expected some differences in response to the various stimuli all but one replied in the affirmative. The expert taking exception to the view that there would be differences stated that there would be no evidence of responses that could be attributed to the rhythmic stimuli. Any changes in HR would be entirely due to the clincial situation in which the Ss were monitored. It was further maintained that even if a response to the rhythmic stimuli could have been expected, the responses would be indifferent. Rhythmic patterns devoid of melodic content could not be the basis for discriminative responses.

For the other experts, all of whom expected differences, there was agreement that when the older children were monitored there would be a noticeable reinforcement of responses to the rhythm that previously had been judged to be difficult. In particular, two of the experts expected a strong response at the Grade VI level to the syncopated rhythm of pattern 6. They felt that such a reaction could be predicted because of the availability of popular dance music.

A difference in response according to the sex of the Ss was not expected.

Comparison of Experimental and Control Groups

The second topic to be dealt with in this chapter concerns findings relevant to the question of whether or not the responses of the experimental Ss were substantially different from those of the control group. In the review of literature it had been pointed out that HR changes occurred whether or not a S was being presented with an affective stimulus. Much of the normal HR change was attributed to sinus arrhythmia. Results calculated from the monitoring of a control group for this study, reaffirmed the presence of HR changes in the absence of a prescribed stimulus. These changes are illustrated by the broken line segments shown in Figure 5, page 44. The question is whether or not changes in HR for the control group were substantially different from the changes observed for the experimental group, (illustrated by the solid line segments in Figure V). Two points of difference in the segmented curves should be noted. The range of responses represented by the solid line segments is smaller for the experimental group than it is for the control group. The direction of the changes as represented by the lines is markedly different for at least 3 out of the 6 stimuli when comparison is made between the experimental and the control groups. In only one of the 6 patterns is there an apparently good fit for the line segments representing responses for the two groups. A statistical test for goodness of fit was omitted because the

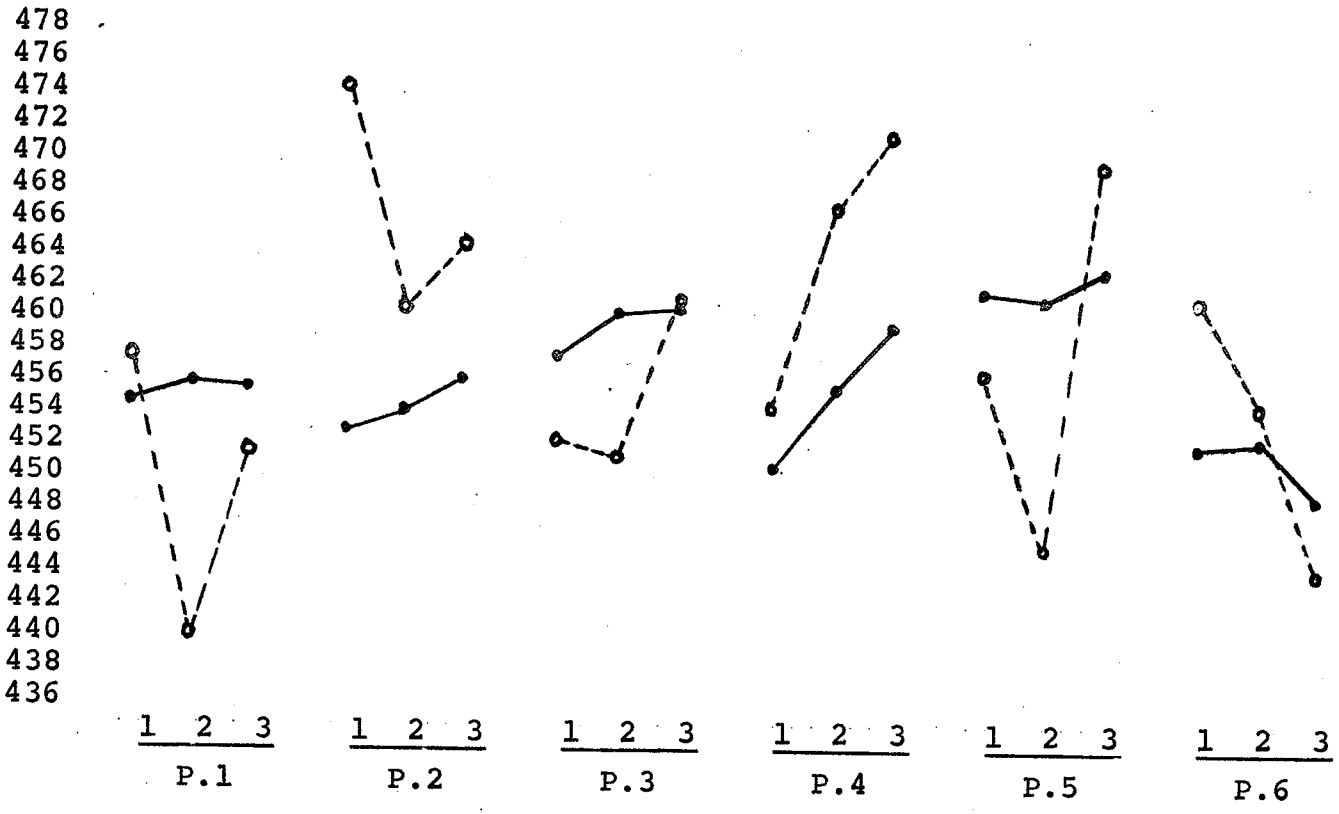

FIGURE 5. Changes in heart rate for each of 6 - 45 second intervals.

——— represents HR changes in response to rhythmic stimulus.

- - - represents HR changes in the absence of rhythmic stimulus.

attenuated range of the response curves made the usual tests for goodness of fit inappropriate.

Rank Ordering of Stimulus Responses

Another topic to be dealt with in recording the findings of the study was related to the rank ordering of stimulus responses. The procedure followed in compiling Table I, page 46 was described previously.

Included in Table I was data regarding the initial rank ordering of the total HR responses for each of the 40 Ss to the various stimuli, as well as the adjusted rank orderings. Adjustments were made in the initial rank orderings for all ranks showing a difference of 15 points or less (15 points is the equivalent in HR of 1 beat per minute). It was stipulated that these ranks were tied and were entered in Table I as such. In those cases where the adjusted ranks demonstrated that the Ss responses lacked discriminability (the ranks were reduced to 3 or less), an asterisk was used to identify the subject. It was of interest to the study to find out which of three possible uses of the data in the table would yield the most information. An examination of Table II, page 48 shows the totals for Ss responses to the stimuli depending on which use was being made of the data in Table I. Table III shows the rank ordering for those totals. The r_s correlation coefficients in Table IV provides the data that lead to the decision to

TABLE I

RANK ORDER OF Ss' RESPONSE TO 45 SEC. RH. PATTERNS, BASED ON HR. TOTALS. RANK 1 = LEAST HR. TOTAL

	Ss	P.1		P.2		P.3		P.4		P.5		P.6	
K-Girls	1	6	6	1	1	5	5	2	2	4	4	3	3
	2	6	6	5	5	3	2	1	1	3	4	3	3
	*3	5	5	5	6	5	4	2.5	2	2.5	2	1	1
	4	1	1	2.5	2	2.5	3	4	4	6	6	4	5
	5	2	2	4	4	4	5	1	1	6	6	4	3
K-Boys	*6	3.5	4	1.5	2	1.5	1	5.5	6	5.5	5	3.5	3
	*7	4.5	4	4.5	3	4.5	5	1.5	2	4.5	6	1.5	1
	8	2.5	2	5	5	2.5	3	4	4	6	6	1	1
	*9	5	5	2.5	3	2.5	2	1	1	5	5	5	6
	10	4	4	6	6	5	5	2	1	2	2	2	3
II-Girls	11	1	1	2	2	5	6	3	3	5	4	5	5
	12	2	1	4	4	2	3	6	6	5	5	2	2
	13	6	6	1.5	2	5	5	3.5	3	3.5	4	1.5	1
	14	3.5	4	1.5	1	3.5	3	1.5	1	6	6	5	5
	*15	1	1	3	2	5.5	5	3	2	5.5	6	3	4
II-Boys	*16	1.5	2	1.5	1	4.5	3	4.5	6	4.5	5	4.5	1
	17	2	2	2	3	6	6	4	4	2	1	5	5
	*18	6	6	3.5	5	3.5	2	3.5	4	3.5	3	1	1
	19	1.5	1	5	5	3.5	4	1.5	2	6	6	3.5	3
	20	2	1	2	3	4	4	6	6	2	1	5	5

(i) Column 1 for each pattern contains the rank after adjustment for "tied" scores, (ranked scores having a difference of 15 or less were designated tied scores--a difference of 15 = a difference of 1 b.p.m.)

TABLE I (continued)

	Ss	P.1		P.2		P.3		P.4		P.5		P.6	
IV-Girls	21	4	4	2	1	2	2	2	3	5	5	6	6
	22	3.5	3	3.5	4	1.5	2	6	6	1.5	1	5	5
	23	3	3	4.5	4	6	6	1.5	1	1.5	2	4.5	5
	*24	1.5	1	5.5	5	1.5	2	3.5	4	3.5	3	5.5	6
	25	1.5	1	3	3	6	6	4	4	5	5	1.5	1
IV-Boys	*26	1.5	1	4	4	4	3	4	5	6	6	1.5	2
	27	3.5	4	5	5	3.5	3	6	6	2	2	1	1
	28	4.5	4	6	6	1	1	2.5	2	4.5	5	2.5	3
	*29	3	3	3	2	3	1	6	6	3	5	3	4
	*30	2.5	1	2.5	2	5.5	6	2.5	3	2.5	4	5.5	5
VI-Girls	*31	3	3	5	4	5	6	1.5	1	5	5	1.5	2
	*32	4.5	6	4.5	4	4.5	3	4.5	4	1.5	1	1.5	2
	33	4.5	4	1.5	1	3	3	4.5	5	6	6	1.5	2
	34	3	3	5.5	6	5.5	5	4	4	1	1	2	2
	35	5	4	1	1	2	2	3	3	5	6	5	4
VI-Boys	*36	1	1	4	6	4	2	4	2	4	5	4	4
	37	2.5	2	4	4	5	5	6	6	2.5	3	1	1
	38	4.5	4	2.5	2	2.5	3	4.5	5	6	6	1	1
	39	3	3	3	2	5	5	1	1	6	6	3	4
	*40	3.5	2	3.5	3	3.5	4	3.5	4	6	6	1	1

(ii) Unadjusted ranks are listed in the second column.

(iii) (*) identifies Ss whose scores were deleted from the calculations for the third set of totals in Table II. Scores for these Ss showed minimal dispersion. Three ranks or less were needed for their scores after adjustment for "ties".

TABLE II

TOTALS FOR THE SUMS OF THE RANK ORDERS ASSIGNED TO INDIVIDUAL STIMULUS RESPONSE (HR) SCORES

		1	2	3	4	5	6
For Adjusted Ranks, (col. 1, Table I).	K-G	20.0	17.5	19.5	10.5	21.5	15.0
	K-B	19.5	19.5	16.0	14.0	23.0	13.0
	II-G	13.5	12.0	21.0	17.0	25.0	16.5
	II-B	13.0	14.0	21.5	19.5	18.0	19.0
	IV-G	13.5	18.5	17.0	17.0	16.5	22.5
	IV-B	15.0	20.5	17.0	21.0	18.0	13.5
	VI-G	20.0	17.5	20.0	17.5	18.5	11.5
	VI-B	14.5	17.0	20.0	19.0	24.5	10.0
	TOTALS	129.0	136.5	152.0	135.5	165.0	121.0
For Non Adjusted Ranks, (col. 2, Table I).	K-G	20.0	22.0	19.0	10.0	22.0	15.0
	K-B	19.0	19.0	16.0	14.0	24.0	14.0
	II-G	13.0	11.0	22.0	15.0	25.0	17.0
	II-B	12.0	17.0	19.0	22.0	16.0	14.0
	IV-G	12.0	17.0	18.0	18.0	16.0	23.0
	IV-B	13.0	19.0	14.0	22.0	22.0	15.0
	VI-G	20.0	16.0	19.0	17.0	19.0	12.0
	VI-B	12.0	17.0	19.0	18.0	26.0	11.0
	TOTALS	121.0	138.0	146.0	136.0	170.0	121.0
Scores After *Ss were Deleted.	K-G	14.0	12.5	14.5	8.0	19.5	14.0
	K-B	6.5	11.0	7.5	6.0	8.0	3.0
	II-G	12.5	9.0	15.5	14.0	19.5	13.5
	II-B	5.5	9.0	13.5	11.5	10.0	13.5
	IV-G	12.0	13.0	15.5	13.5	13.0	17.0
	IV-B	8.0	11.0	4.5	8.5	6.5	3.5
	VI-G	12.5	8.0	10.5	11.5	12.0	8.5
	VI-B	10.0	9.5	12.5	11.5	14.5	5.0
	TOTALS	81.0	83.0	94.0	84.5	102.5	78.0

TABLE III

RANK ORDERS FOR THE TOTALS GIVEN IN TABLE II

		P.1	P.2	P.3	P.4	P.5	P.6
A.	R.O. for Totals for Adjusted Ranks	129.0 (2)	136.5 (4)	152.0 (5)	135.5 (3)	165.0 (6)	121.0 (1)
B.	R.O. for Totals for Non Adjusted Ranks	121.0 (1.5)	138.0 (4)	146.0 (5)	136.0 (3)	170.0 (6)	121.0 (1.5)
C.	R.O. for Totals when *Ss were Deleted	81.0 (2)	83.0 (3)	94.0 (5)	84.5 (4)	102.5 (6)	78.0 (1)

TABLE IV

r_s CORRELATION COEFFICIENTS FOR THE THREE INTERCORRELATIONS BETWEEN A, B, AND C, TABLE III

r_s for A and B	.986
r_s for A and C	.993
r_s for B and C	.929

Critical value r_s (.05) = .829 therefore there is no significant difference between the rank ordering for the totals whether they are based on adjusted, non adjusted or partially deleted ranks.

use the adjusted ranks as the basis for the generation of all further tables. The rank ordering of the totals for the adjusted ranks, identified in Table IV as "A", is common to the two highest inter-correlations.

Matrices of Frequencies of Rank Orderings

The matrices of frequencies of rank orderings are of particular interest to the findings of the study. The matrices yielded much of the information relevant to the conclusions to be drawn from the study. Table V, page 51 provided results gained from counting the frequency with which each of the 11 ranks was assigned to the 6 different rhythmic patterns. The total of 40 Ss was taken into account in compiling this table. The high frequencies of fourth, fifth and sixth rankings for patterns 3 and 5 becomes evident from an examination of Table V. Patterns 1 and 6 show frequencies as high as 7 in each of the top, middle and bottom rankings. An examination of the total for the weighted scores of patterns 2 and 4 indicates a margin of only 1.0 point between the totals. Patterns 2 and 4 appear to be equally ranked at a point roughly midway between patterns 3 and 5 and patterns 1 and 6.

Findings of the study related to observed differences in response according to sex and/or grade are presented in Table V. Table VI presents in summary form the rank orders of the weighted score totals according to

TABLE V

MATRIX OF FREQUENCIES FOR RANKS ASSIGNED TO THE HEART RATE SCORES

WEIGHTED SCORES (frequency x rank), ARE SHOWN IN THE COLUMNS THAT ALTERNATE WITH THE FREQUENCIES

1. SUMMARY - Girls and Boys, K-VI N = 40

R*	P_1		P_2		P_3		P_4		P_5		P_6	
6	4	24.0	2	12.0	3	18.0	6	36.0	10	60.0	1	6.0
5.5	-	-	2	11.0	3	16.5	1	5.5	2	11.0	2	11.0
5	3	15.0	6	30.0	8	40.0	-	-	7	35.0	7	35.0
4.5	5	22.5	3	13.5	3	13.5	4	18.0	3	13.5	2	9.0
4	2	8.0	5	20.0	4	16.0	7	28.0	2	8.0	3	12.0
3.5	5	17.5	3	10.5	5	17.5	4	14.0	3	10.5	2	7.0
3	5	15.0	4	12.0	3	9.0	3	9.0	2	6.0	5	15.0
2.5	3	7.5	4	10.0	4	10.0	3	7.5	3	7.5	1	2.5
2	4	8.0	4	8.0	3	6.0	3	6.0	4	8.0	3	6.0
1.5	5	7.5	5	7.5	3	4.5	5	7.5	3	4.5	7	10.5
1	4	4.0	2	2.0	1	1.0	4	4.0	1	1.0	7	7.0
TOTALS: Weighted Scores		129.0		136.5		152.0		135.5		165.0		121.0
r.o. - Weighted Scores		(2)		(4)		(5)		(3)		(6)		(1)

*adjusted ranks have been used in the matrix.

TABLE V (continued)

2.a GIRLS - K-VI (primary and elementary) N = 20

R*	P.1		P.2		P.3		P.4		P.5		P.6	
6	3	18.0	-	-	2	12.0	2	12.0	4	24.0	1	6.0
5(5.5)	2	10.0	5	26.0	10	36.0	-	-	7	35.5	5	25.5
4(4.5)	3	13.0	4	17.0	2	8.5	5	21.0	1	4.0	3	12.5
3(3.5)	5	16.0	3	9.5	3	9.5	5	16.0	3	10.0	3	9.0
2(2.5)	2	4.0	3	6.5	4	8.5	3	6.5	1	2.5	2	4.0
1(1.5)	5	6.0	5	6.5	2	3.0	5	6.5	4	5.5	6	8.5
TOTALS: w. scores		67.0		65.5		77.5		62.0		81.5		65.5
r.o - w. scores		(4)		(2.5)		(5)		(1)		(6)		(2.5)

2.b BOYS - K-VI (primary and elementary) N = 20

R*	P.1		P.2		P.3		P.4		P.5		P.6	
6	1	6.0	2	12.0	1	6.0	4	24.0	6	36.0	-	-
5(5.5)	1	5.0	3	15.0	4	20.5	1	5.5	2	10.5	4	20.5
4(4.5)	4	17.5	4	16.5	5	21.0	6	25.0	4	17.5	2	8.5
3(3.5)	5	16.5	4	13.0	5	17.0	2	7.0	2	6.5	4	13.0
2(2.5)	5	11.5	5	11.5	3	7.5	3	7.0	6	13.0	2	4.5
1(1.5)	4	5.5	2	3.0	2	2.5	4	5.0	-	-	8	9.0
TOTALS: w. scores		62.0		71.0		74.5		73.5		83.5		55.5
r.o - w. scores		(2)		(3)		(5)		(4)		(6)		(1)

TABLE V (continued)

2.c GIRLS - K and II (primary) N = 10

R*	P.1		P.2		P.3		P.4		P.5		P.6	
6	3	18.0	-	-	-	-	1	6.0	3	18.0	-	-
5(5.5)	1	5.0	2	10.0	5	25.5	-	-	3	15.5	2	10.0
4(4.5)	-	-	2	8.0	1	4.0	1	4.0	1	4.0	2	8.0
3(3.5)	1	3.5	1	3.0	2	6.5	3	9.5	2	6.5	3	9.0
2(2.5)	2	4.0	2	4.5	2	4.5	2	4.5	1	2.5	1	2.0
1(1.5)	3	3.0	3	4.0	-	-	3	3.5	-	-	2	2.5
TOTALS: w. scores		33.5		29.5		40.5		27.5		46.5		31.5
r.o - w. scores		(4)		(2)		(5)		(1)		(6)		(3)

2.d GIRLS - IV and VI (elementary) N = 10

R*	P.1		P.2		P.3		P.4		P.5		P.6	
6	-	-	-	-	2	12.0	1	6.0	1	6.0	1	6.0
5(5.5)	1	5.0	3	16.0	2	10.5	-	-	4	20.0	3	15.5
4(4.5)	3	13.0	2	9.0	1	4.5	4	17.0	-	-	1	4.5
3(3.5)	4	12.5	2	6.5	1	3.0	2	6.5	1	3.5	-	-
2(2.5)	-	-	1	2.0	2	4.0	1	2.0	-	-	1	2.0
1(1.5)	2	3.0	2	2.5	2	3.0	2	3.0	4	5.5	4	6.0
TOTALS: w. scores		33.5		36.0		37.0		34.5		35.0		34.0
r.o. - w. scores		(1)		(5)		(6)		(3)		(4)		(2)

*adjusted ranks have been used.

TABLE V (continued)

2.e BOYS - K and II (primary) N = 10

R*	P.1		P.2		P.3		P.4		P.5		P.6	
6	1	6.0	1	6.0	1	6.0	1	6.0	2	12.0	-	-
5(5.5)	1	5.0	2	10.0	1	5.0	1	5.5	2	10.5	3	15.0
4(4.5)	2	8.5	1	4.5	3	13.0	3	12.5	2	9.0	1	4.5
3(3.5)	1	3.5	1	3.5	2	7.0	1	3.5	1	3.5	2	7.0
2(2.5)	3	6.5	3	6.5	2	5.0	1	2.0	3	6.0	1	2.0
1(1.5)	2	3.0	2	3.0	1	1.5	3	4.0	-	-	3	3.5
TOTALS: w. scores		32.5		33.5		37.5		33.5		41.0		32.0
r.o. - w. scores		(2)		(3.5)		(5)		(3.5)		(6)		(1)

2.f BOYS - IV and VI (elementary) N = 10

R*	P.1		P.2		P.3		P.4		P.5		P.6	
6	-	-	1	6.0	-	-	3	18.0	4	24.0	-	-
5(5.5)	-	-	1	5.0	3	15.5	-	-	-	-	1	5.5
4(4.5)	2	9.0	3	12.0	2	8.0	3	12.5	2	8.5	1	4.0
3(3.5)	4	13.0	3	9.5	3	10.0	1	3.5	1	3.0	2	6.0
2(2.5)	2	5.0	2	5.0	1	2.5	2	5.0	3	7.0	1	2.5
1(1.5)	2	2.5	-	-	1	1.0	1	1.0	-	-	5	5.5
TOTALS; w. scores		29.5		37.5		37.0		40.0		42.5		23.5
r.o. - w. scores		(2)		(4)		(3)		(5)		(6)		(1)

*adjusted ranks have been used.

TABLE V (continued)

3.a K and II - Girls and Boys (primary) N = 20

R*	P.1		P.2		P.3		P.4		P.5		P.6	
6	4	24.0	1	6.0	1	6.0	2	12.0	5	30.0	-	-
5(5.5)	2	10.0	4	20.0	6	30.5	1	5.5	5	26.0	5	25.0
4(4.5)	2	8.5	3	12.5	4	17.0	4	16.5	3	13.0	3	12.5
3(3.5)	2	7.0	2	6.5	4	13.5	4	13.0	3	10.0	5	16.0
2(2.5)	5	10.5	5	11.0	4	9.5	3	6.5	4	8.5	2	4.0
1(1.5)	5	6.0	5	7.0	1	1.5	6	7.5	-	-	5	6.0
TOTALS: w. scores		66.0		63.0		78.0		61.0		87.5		63.5
r.o. - w. scores		(4)		(2)		(5)		(1)		(6)		(3)

3.b IV and VI - Girls and Boys (elementary) N = 20

R*	P.1		P.2		P.3		P.4		P.5		P.6	
6	-	-	1	6.0	2	12.0	4	24.0	5	30.0	1	6.0
5(5.5)	1	5.0	4	21.0	5	26.0	-	-	4	20.0	4	21.0
4(4.5)	5	22.0	5	21.0	3	12.5	7	29.5	2	8.5	2	8.5
3(3.5)	8	25.5	5	16.0	4	13.0	3	10.0	2	6.5	2	6.0
2(2.5)	2	5.0	3	7.0	3	6.5	3	7.0	3	7.0	2	4.5
1(1.5)	4	5.5	2	2.5	3	4.0	3	4.0	4	5.5	9	11.5
TOTALS: w. scores		63.0		73.5		74.0		74.5		77.5		57.5
r.o. - w. scores		(2)		(3)		(4)		(5)		(6)		(1)

*adjusted ranks have been used.

TABLE V (continued)

3.c KINDERGARTEN - Girls and Boys N = 10

R*	P.1		P.2		P.3		P.4		P.5		P.6	
6	2	12.0	1	6.0	-	-	-	-	3	18.0	-	-
5(5.5)	2	10.0	3	15.0	3	15.0	1	5.5	2	10.5	1	5.0
4(4.5)	2	8.5	2	8.5	2	8.5	2	8.0	2	8.5	2	8.0
3(3.5)	1	3.5	-	-	1	3.0	-	-	1	3.0	3	9.5
2(2.5)	2	4.5	2	5.0	3	7.5	3	6.5	2	4.5	1	2.0
1(1.5)	1	1.0	2	2.5	1	1.5	4	4.5	-	-	3	3.5
TOTALS: w. scores		39.5		37.0		35.5		24.5		44.5		28.0
r.o. - w. scores		(5)		(4)		(3)		(1)		(6)		(2)

3.d II - Girls and Boys N = 10

R*	P.1		P.2		P.3		P.4		P.5		P.6	
6	2	12.0	-	-	1	6.0	2	12.0	2	12.0	-	-
5(5.5)	-	-	1	5.0	3	15.5	-	-	3	15.5	4	20.0
4(4.5)	-	-	1	4.0	2	8.5	2	8.5	1	4.5	1	4.5
3(3.5)	1	3.5	2	6.5	3	10.5	4	13.0	2	7.0	2	6.5
2(2.5)	3	6.0	3	6.0	1	2.0	-	-	2	4.0	1	2.0
1(1.5)	4	5.0	3	4.5	-	-	2	3.0	-	-	2	2.5
TOTALS: w. scores		26.5		26.0		42.5		36.5		43.0		35.5
r.o. - w. scores		(2)		(1)		(5)		(3)		(6)		(4)

*adjusted ranks have been used.

TABLE V (continued)

3.e IV - Girls and Boys N = 10

R*	P.1		P.2		P.3		P.4		P.5		P.6	
6	-	-	1	6.0	2	12.0	3	18.0	1	6.0	1	6.0
5(5.5)	-	-	2	10.5	1	5.5	-	-	2	10.0	3	16.0
4(4.5)	2	8.5	2	8.5	1	4.0	2	8.0	1	4.5	1	4.5
3(3.5)	4	13.0	3	9.5	2	6.5	1	3.5	2	6.5	1	3.0
2(2.5)	1	2.5	2	4.5	1	2.0	3	7.0	2	4.5	1	2.5
1(1.5)	3	4.5	-	-	3	4.0	1	1.5	2	3.0	3	4.0
TOTALS: w. scores		28.5		39.0		34.0		38.0		34.5		36.0
r.o. - w. scores		(1)		(6)		(2)		(5)		(3)		(4)

3.f VI - Girls and Boys N = 10

R*	P.1		P.2		P.3		P.4		P.5		P.6	
6	-	-	-	-	-	-	1	6.0	4	24.0	-	-
5(5.5)	1	5.0	2	10.5	4	20.5	-	-	2	10.0	1	5.0
4(4.5)	3	13.5	3	12.5	2	8.5	5	21.5	1	4.0	1	4.0
3(3.5)	4	12.5	2	6.5	2	6.5	2	6.5	-	-	1	3.0
2(2.5)	1	2.5	1	2.5	2	4.5	-	-	1	2.5	1	2.0
1(1.5)	1	1.0	2	2.5	-	-	2	2.5	2	2.5	6	7.5
TOTALS: w. scores		34.5		34.5		40.0		36.5		43.0		21.5
r.o. - w. scores		(2.5)		(2.5)		(5)		(4)		(6)		(1)

*adjusted ranks have been used.

TABLE VI

LIST OF RANK ORDERS OF WEIGHTED SCORE TOTALS FOR ALL MATRICES IN TABLE V

		P.1	P.2	P.3	P.4	P.5	P.6
1. TOTAL Ss,	N=40	(2)	(4)	(5)	(3)	(6)	(1)
2.a G:K-VI,	N=20	(4)	(2.5)	(5)	(1)	(6)	(2.5)
b B:K-VI,	N=20	(2)	(3)	(5)	(4)	(6)	(1)
c G:K-II,	N=10	(4)	(2)	(5)	(1)	(6)	(3)
d G:IV-VI,	N=10	(1)	(5)	(6)	(3)	(4)	(2)
e B:K-II,	N=10	(2)	(3.5)	(5)	(3.5)	(6)	(1)
f B:IV-VI,	N=10	(2)	(4)	(3)	(5)	(6)	(1)
3.a K-II:GB,	N=20	(4)	(2)	(5)	(1)	(6)	(3)
b IV-VI:GB,	N=20	(2)	(3)	(4)	(5)	(6)	(1)
c K:GB,	N=10	(5)	(4)	(3)	(1)	(6)	(2)
d II:GB,	N=10	(2)	(1)	(5)	(3)	(6)	(4)
e IV:GB,	N=10	(1)	(6)	(2)	(5)	(3)	(4)
f VI:GB,	N=10	(2.5)	(2.5)	(5)	(4)	(6)	(1)

selected sex/grade categories. The most prominent feature of Table VI is not in terms of a difference but rather in terms of a similarity of response. Rank orderings of 5 or 6 for patterns 3 or 5 occur repeatedly. Grade IV girls and boys are the only category having both patterns 3 and 5 ranked other than 5 or 6. Any differences in ranking, according to grade or sex, are effected largely by variations in rank orderings for patterns 1, 2, 4, and 6. Exceptions to the general case will be noted in connection with significant inter-correlations between categories.

Patterns in rank ordering of weighted score totals that indicated possible reinforcement or extinction of response to the various rhythmic stimuli were looked for in Table VI. Evidence, for example, that there was reinforcement of response to "difficult" rhythms as children progressed through the grades in school, with corresponding evidence that response to "simple" rhythms was extinguished, would be of great value to curriculum planners. The patterns that were looked for, indicating reinforcement or extinction were not found, with the possible exception of the unaccented quarter-note rhythms (P.1). Rankings of response to P.1 for K, II, IV and VI shows a relatively high ranking of 4 at the K-level and a tendency for progressively lower rankings through grades II, IV and VI.

Rank Order Correlations (r_s) Between Categories of Ss

Rank order correlation (r_s) between the various categories of Ss were calculated. The results are found in Table VII, page 61. The r_s correlation coefficient for Boys:K-VI and the total group (.94), and the r_s for Boys: K-II and the total group (.99), deserve particular attention. The further correlation of Boys:K-II with Boys:I-VI (.99) is also worthy of note.

The findings reported in this chapter included a report on the opinions of experts relevant to the study. Also included was a graph representing the response curves generated by the experimental group as compared to a control group. Evidence was presented to support the use of rank orders that had been adjusted for "ties" as the basis from which the remaining tables should be generated. The tables that were generated on the basis of the adjusted rank orderings in turn yielded data from which conclusions for the study were to be drawn.

TABLE VII

MATRIX OF r_s CORRELATION COEFFICIENTS
(decimal point omitted)

Categories	Total Ss	2	3	4	5	6	7	8	9	10	11	12	13
1. Total Ss	--												
2. G:K-VI	64	--											
3. B:K-VI	94*	56	--										
4. G:K-II	54	99*	54	--									
5. G:IV-VI	77	30	66	20	--								
6. B:K-II	99*	61	99*	53	73	--							
7. B:IV-VI	77	19	83	09	43	81	--						
8. K-II:GB	54	99*	49	100*	20	53	09	--					
9. IV-VI:GB	83	33	94*	26	49	93*	94*	26	--				
10. K:GB	49	79	31	71	03	44	26	71	20	--			
11. II:GB	49	80	60	71	71	56	26	71	49	14	--		
12. IV:GB	-03	-47	-09	-71	-71	-04	31	-71	09	-43	-37	--	
13. VI:GB	90*	61	99*	56	56	96*	79	56	93*	36	64	-21	--

CHAPTER V

SUMMARY AND CONCLUSIONS

Summary

In this study attention has been drawn to some value oriented questions that are being raised about education. It was pointed out that answering these questions at this time was related, in part, to the necessity to justify the high expenditures on education to the agencies responsible for providing the monies for educational needs.

It was noted that at the same time value oriented questions were being asked about education in general, educators were becoming increasingly aware of the need to have a new look at the value of particular programs. For a music educator, evaluation of programs is made particularly difficult by a lack of objective measurement data in domains of the affective realm. It was the lack of such data that provided much of the reason for initiating this study.

A survey of research procedures that might be useful in generating objective data in the affective domain lead to an awareness of psychophysiology. It became apparent that the application of this relatively new discipline to problems in music education was likely to

produce worthwhile results. Findings of this study that appear to have confirmed this possibility included the following: changes in heart rate (HR) occured in the presence of rhythmic stimuli. These changes were independent of normal changes in HR such as those attributed to sinus arrhythmia. It was possible to rank order the rhythmic stimuli according to the HR changes coincidental with each of the stimuli. Examination of the resulting rank ordering produced objective data that provided an alternative source of information to expert opinion that has served as the sole basis for curriculum evaluation in the past.

Conclusions

Conclusions from the study are organized under two main headings. First, there is the question of how, in the light of psychophysiological research, the study's findings are to be interpreted. Second, having arrived at an interpretation of the findings, what are the implications of the findings for curriculum evaluation.

It has been demonstrated that Ss responded differentially to the six rhythmic stimuli used in the study. Differentiation of response was based on the varying increases in HR that accompanied the stimuli. The interpretation of the observed increases in HR is made difficult by the fact that much of the research reported in the review of literature noted acceleration of HR in response

to stimuli that were judged to have been noxious to the Ss. (Hord, Lubin, and Johnson, 1966 in commenting on the findings of Lacey, 1959 and Obrist, 1963). Set against this interpretation of the significance of HR acceleration, acceleration being synonymous with the positive "sign of the overall HR responses" (Hord, Lubin, and Johnson, 1966), was the observation by Roessler, Collins, and Burch (1969) that HR acceleration typically accompanied presentation of auditory stimuli. It is difficult to avoid the conclusion that auditory stimuli are of a mode that elicits a defensive reflex from Ss with its concomitant acceleratory HR (Raskin, Kotscs, and Bever, 1969).

In terms of the present study the opinions of experts have been given as evidence to the effect that the auditory stimuli used in this study were not "noxious" and yet the overall sign of HR change was positive. A possible explanation for the discrepancy between the judgment of the experts and the consistent increase in reported HR, is to be found in a research report by Edwards and Alsip (1969). They were referring to the conclusions of Lacey et al (1963) with regard the possible link between pleasant and unpleasant stimuli and HR deceleration and acceleration. It was argued by Lacey that pleasant-unpleasant stimuli were not dichotomous but were ordered along a continuum. Assuming the ordering of stimuli along a continuum to pertain here, it is conceivable that below the threshold of

what might be considered noxious there exists a range of stimuli that are irritating in a manner that might be better described as being stimulating. At this point it becomes heuristically appealing to suppose that the human "fondness" for rhythm is an attribute of the psychological need for just such irritation (stimulation). The desire to be in the presence of rhythmically oriented music may be a form of thrill seeking the fulfilment of a temporary need for a self imposed state of anxiety.

> It would seem however, that the acceleration component is probably the response associated with anxiety and that the deceleration observed in these experiments may be associated with preparation to "attend" to any type of stimulus event.
>
> (Deane, 1969)

In this context it becomes understandable that rhythmic stimuli frequently elicit physical response such as dance, since motor activity is typically associated with attempts to relieve a person of states of anxiety.

To summarize, the rhythmic stimuli presented to the Ss in this study are thought to fall above the level of what might be considered pleasant on the pleasant-unpleasant continuum of stimuli, and below the threshold of what might be called noxious. From this it is concluded the stimuli associated with low ranked levels of HR response are measures of affective indifference and the high stimuli associated with high ranked levels are measures of the extent to which the Ss found the rhythms "thrilling".

On the basis of this interpretation of the meaning

of HR increases a number of conclusions are drawn from the findings of the study that have implications for curriculum evaluation.

The first conclusion is that children in this restricted sample show a tendancy toward extinction of response to a repeated quarter-note rhythm. The repeated quarter-note rhythm would seem to represent the lower limit to what children find interesting rhythmically. On the other hand, although the Ss response to the syncopated rhythm of pattern number 6 was as indifferent as the response to the quarter-note rhythm, a similar pattern of extinction was not evident. This leads to the conclusion that Ss were unable to extract rhythmic meaning from P.6. P.6 then becomes the upper limit to the kinds of rhythms likely to stimulate children K-VI.

Identification of P.6 as being beyond the rhythmic interest of elementary school children is given added credence when we come to draw conclusions about the fifth and sixth rankings for patterns 3 and 5. In terms of rhythmic difficulty it may be recalled that experts ranked patterns 3 and 5 in fifth and second positions respectively. The fact that the children's response to these rhythms show that they are "thrilled" by them seems to be another way of saying that the children need much more experience with rhythms similar to P.3 and P.5 before they are ready to be stimulated by more sophisticated patterns such as P.6.

The implications for curriculum evaluation from this conclusion are both in terms of song selection and also in terms of the musical activities that might be suggested as being valuable to a child's rhythmic development in the elementary school. The popularity of songs requiring the enunciation of many syllables to the beat eg. Grandma Grunts, What Shall We Do With A Drunken Sailor and The Drummer And The Cook, may very well depend for their popularity on the measure of "thrillingness" the Ss have given to pattern 3 of the study. Furthermore, the high ranking given to pattern 5 immediately suggests the desirability of incorporating into the singing of the songs of a rather common rhythmic content, opportunities for the children to accompany themselves on instruments that allow for an active motor response. Instruments such as song bells, xylophones, autoharps, percussion instruments are appropriate for this purpose. The point to be made here is not that this kind of musical enterprise should become an end in itself, but rather that children need the opportunity to become satiated with common rhythmic experiences before they are likely to be ready to be stimulated by more sophisticated rhythms. It will always have to be borne in mind that some children will pass through successive stages of becoming satiated more quickly than others. Evidence to support this remark is not difficult to find when attention is given to individual Ss responses to the rhythmic stimuli.

Other implications for curriculum evaluation derive from findings that show significant correlations between Boys:K-VI and Total Ss (.94), Boys:K-II and Total Ss (.99), and Boys:K-II and Boys:K-VI (.99). It is concluded from a comparison of the correlations between these categories of Ss with all other significant correlations, that boys alone correlate with the Total group, with Boys:K-II contributing most to the correlation. Boys:K-II are therefore the best predictors of how children I-VI are likely to respond to rhythmic stimuli. Much time and expense can thus be saved if further studies of the kind reported here concentrate on monitoring the responses of boys in the 5-7 year old range.

Finally, attention must be given to conclusions to be drawn from a comparison of the opinion of the experts as compared to the findings of the study. In one instance an expert did not anticipate the study's findings in any way. In the remaining four instances, the experts were surprised to varying degrees, when they compared their opinions with the study's findings. At no time did they suspect, for instance, that 2 of the 6 stimuli would be preferred by all but one category of student. It is the fact that there were surprises that suggests the need for objective data to supplement the opinion of experts when music programs are being evaluated and further, it is concluded that the application of psychophysiological techniques to the affective domain is one way to produce the necessary data.

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APPENDIX

APPENDIX I

TOTAL HEART RATE SCORES BASED ON READINGS TAKEN EVERY 3 SECONDS OVER 15 SECOND INTERVALS

		Pattern 1				Pattern 2			
		1	2	3	Totals	1	2	3	Totals
K:Girls	1.	593	578	651	1822	542	555	532	1629
	2.	444	444	460	1348	427	432	455	1314
	3.	446	454	446	1346	452	450	448	1350
	4.	498	494	493	1485	501	509	494	1504
	5.	444	481	402	1321	458	445	442	1345
		2425	2451	2452	7328	2380	2391	2371	7142
K: Boys	6.	498	501	531	1530	495	506	516	1517
	7.	475	490	482	1447	482	482	479	1443
	8.	505	496	507	1508	524	512	518	1554
	9.	459	460	462	1381	449	444	462	1355
	10.	552	524	533	1609	578	598	625	1801
		2489	2471	2515	7475	2528	2542	2600	7670
II: Girls	11.	434	430	420	1284	445	443	421	1309
	12.	427	450	407	1284	440	429	440	1309
	13.	403	414	431	1284	403	375	380	1158
	14.	381	366	397	1144	366	372	373	1111
	15.	457	464	456	1377	463	474	478	1415
		2102	2124	2111	6373	2117	2093	2092	6302
II: Boys	16.	330	325	334	989	322	320	335	977
	17.	417	402	411	1230	403	412	416	1231
	18.	540	480	500	1520	497	482	490	1469
	19.	506	521	488	1515	538	527	504	1569
	20.	427	432	438	1297	435	430	436	1301
		2220	2160	2171	6551	2195	2171	2181	6547

APPENDIX I (continued)

	Pattern 3				Pattern 4			
	1	2	3	Totals	1	2	3	Totals
1.	619	596	586	1801	545	558	564	1667
2.	420	445	424	1289	400	402	462	1264
3.	442	464	430	1336	424	438	446	1308
4.	498	491	519	1508	508	495	516	1519
5.	428	451	474	1353	402	423	474	1299
	2407	2447	2433	7287	2279	2316	2462	7057
6.	501	502	500	1503	503	508	539	1550
7.	487	481	480	1448	465	471	465	1401
8.	502	507	507	1516	518	515	499	1532
9.	443	453	454	1350	447	436	446	1329
10.	568	596	622	1786	516	533	532	1581
	2501	2539	2563	7603	2449	2463	2481	7395
11.	458	453	461	1372	454	440	442	1336
12.	427	430	443	1300	483	469	463	1415
13.	420	411	416	1247	401	410	392	1203
14.	391	371	374	1136	368	371	372	1111
15.	500	482	460	1442	466	475	474	1415
	2196	2147	2154	6497	2172	2165	2143	6480
16.	343	327	329	999	337	339	331	1007
17.	428	451	442	1321	411	439	414	1264
18.	485	476	487	1448	483	489	489	1461
19.	559	538	557	1654	525	494	506	1525
20.	445	451	448	1344	429	489	472	1390
	2260	2243	2263	6766	2185	2250	2212	6647

APPENDIX I (continued)

	Pattern 5				Pattern 6			
	1	2	3	Totals	1	2	3	Totals
1.	594	574	585	1753	566	560	563	1689
2.	448	444	408	1300	428	426	439	1293
3.	429	452	427	1308	430	416	435	1281
4.	526	524	537	1587	503	496	525	1524
5.	441	472	460	1373	435	466	441	1342
	2438	2466	2417	7321	2362	2364	2403	7129
6.	523	515	508	1546	500	518	511	1529
7.	492	481	485	1458	467	461	472	1400
8.	534	500	543	1577	501	484	493	1478
9.	449	473	454	1376	465	473	447	1385
10.	538	528	533	1599	546	534	524	1604
	2536	2497	2523	7556	2479	2470	2447	7396
11.	447	456	458	1361	449	462	455	1366
12.	426	429	452	1397	440	427	421	1288
13.	415	389	408	1212	373	394	382	1149
14.	395	385	395	1175	389	384	389	1157
15.	503	479	461	1443	456	476	488	1420
	2186	2138	2264	6588	2107	2143	2130	6380
16.	340	337	326	1003	335	337	329	1001
17.	433	398	398	1229	427	448	420	1295
18.	486	492	474	1452	472	470	473	1415
19.	530	528	529	1587	522	517	513	1552
20.	434	432	432	1298	450	457	456	1363
	2223	2187	2159	6569	2206	2229	2191	6626

APPENDIX I (continued)

		Pattern 1				Pattern 2			
		1	2	3	Totals	1	2	3	Totals
IV: Girls	21.	537	539	537	1613	520	527	532	1579
	22.	524	543	533	1600	510	561	540	1611
	23.	554	555	544	1653	568	555	565	1688
	24.	405	375	382	1162	427	407	386	1220
	25.	491	490	495	1476	514	508	498	1520
		2511	2502	2491	7504	2539	2558	2521	7618
IV: Boys	26.	371	383	328	1082	361	388	378	1127
	27.	433	419	388	1240	409	421	421	1251
	28.	444	429	424	1297	456	442	425	1323
	29.	474	481	473	1428	458	483	485	1426
	30.	459	443	432	1334	448	442	445	1335
		2181	2155	2045	6381	2132	2176	2154	6462
VI: Girls	31.	482	466	491	1439	464	490	505	1459
	32.	369	373	390	1132	378	370	382	1130
	33.	489	518	485	1492	469	477	473	1419
	34.	442	458	498	1398	494	469	493	1456
	35.	464	490	505	1459	468	445	474	1387
		2246	2305	2369	6920	2273	2251	2327	6851
VI: Boys	36.	397	383	375	1155	398	400	407	1205
	37.	324	321	321	966	314	324	336	974
	38.	461	461	469	1391	434	435	459	1328
	39.	372	361	367	1100	359	376	357	1092
	40.	439	442	429	1310	443	439	428	1310
		1993	1968	1961	5922	1948	1974	1987	5909

APPENDIX I (continued)

	Pattern 3				Pattern 4			
	1	2	3	Totals	1	2	3	Totals
21.	538	544	508	1590	516	550	528	1594
22.	526	518	539	1583	533	564	568	1665
23.	582	575	577	1734	534	538	533	1634
24.	390	382	397	1169	396	402	405	1203
25.	537	561	535	1633	529	540	531	1600
	2573	2580	2556	7709	2517	2594	2585	7696
26.	378	374	373	1125	384	371	385	1140
27.	391	409	437	1237	411	435	415	1261
28.	413	420	422	1255	424	433	423	1280
29.	477	470	478	1425	482	486	477	1445
30.	456	458	456	1370	434	448	457	1339
	2115	2131	2166	6412	2135	2173	2157	6465
31.	473	495	497	1465	460	457	476	1393
32.	371	371	376	1118	369	381	380	1130
33.	482	489	493	1464	505	498	499	1502
34.	483	458	513	1454	469	459	500	1428
35.	475	495	433	1403	482	466	491	1439
	2284	2308	2312	6904	2285	2261	2346	6892
36.	390	408	394	1192	392	401	399	1192
37.	334	325	330	989	356	337	330	1023
38.	432	451	449	1332	442	467	483	1392
39.	363	369	394	1126	356	337	330	1023
40.	438	446	438	1322	441	443	438	1322
	1957	1999	2005	5961	1987	1985	1980	5952

APPENDIX I (continued)

	Pattern 5				Pattern 6			
	1	2	3	Totals	1	2	3	Totals
21.	548	541	543	1632	549	558	561	1668
22.	520	515	543	1578	550	532	548	1630
23.	548	549	547	1644	576	554	569	1699
24.	404	403	386	1193	442	401	389	1232
25.	511	549	557	1617	486	499	492	1477
	2531	2557	2576	7664	2603	2544	2559	7706
26.	391	380	377	1148	375	350	364	1089
27.	398	405	386	1190	387	385	384	1156
28.	430	452	424	1306	427	428	427	1282
29.	486	472	474	1432	473	484	472	1429
30.	466	436	447	1349	448	464	447	1359
	2171	2146	2108	6425	2110	2111	2094	6315
31.	511	518	532	1561	475	495	433	1403
32.	369	364	355	1088	363	358	374	1095
33.	509	535	509	1553	476	501	450	1427
34.	439	446	462	1347	459	460	452	1371
35.	517	518	528	1563	473	495	491	1459
	2345	2381	2386	7112	2246	2309	2200	6755
36.	403	389	407	1199	405	396	392	1193
37.	318	327	324	969	307	319	312	938
38.	479	476	469	1424	439	418	437	1294
39.	368	402	394	1164	371	376	360	1107
40.	447	451	445	1343	434	417	426	1277
	2015	2045	2039	6099	1956	1926	1927	5809