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Effects of rhythmic modeling on sport skill acquisition

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EFFECTS OF RHYTHMIC MODELING
ON SPORT SKILL ACQUISITION

by

Douglas W. Walker

An Abstract

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ABSTRACT

The effects of rhythmic modeling on sport skill acquisition were examined. Four sessions divided into instruction, practice, live demonstration, and recording sections were experienced by all subjects during a 2-week period, except for subjects in the practice only group who received a practice, live demonstration, and recording period. Forty-six college age physical education gymnastics students attending either a central New York university or college served as subjects. Prescriptions for the two treatment groups during the instruction periods included either a videotape of a selected sport maneuver or a rhythmic audiotape created using Dalcrozian Eurhythmic analytical technique. Subsequent performances of subjects were adjusted for tempo difference and translated to graphic form utilizing the same Dalcrozian method. These patterns were then matched against the original rhythmic model pattern. An analysis of covariance performed on the data suggested that no significant rhythmic modeling occurred. ANCOVA resulted in a nonsignificant group effect, $F(2, 20) = 0.53$, $p > .05$, and a nonsignificant day effect, $F(2, 24) = 0.31$, $p > .05$. Also there was no significant group x day interaction, $F(4, 42) = 0.38$, $p > .05$. The rejection of the research hypothesis for group, day, and group x day

effects may have been due to loss of attention, loss of motivation, and individual differences among subjects.

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ON SPORT SKILL ACQUISITION

A Thesis Presented to the Faculty of the
School of Health, Physical
Education, and Recreation
Ithaca College

In Partial Fulfillment of the
Requirements for the Degree
Master of Science

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by

Douglas W. Walker

December 1987

Ithaca College

School of Health, Physical Education, and Recreation

CERTIFICATE OF APPROVAL

MASTER OF SCIENCE THESIS

This is to certify that the Master of Science Thesis of

Douglas W. Walker

submitted in partial fulfillment of the requirements for the degree of Master of Science in the School of Health, Physical Education, and Recreation at Ithaca College has been approved.

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Chapter 1

INTRODUCTION

A single-celled organism pulsates with life, and the galaxy in which it exists oscillates in accompaniment. Between them stretches one unifying interface, namely rhythm. In the center of these two extremes falls the human body, and within this being various organs and systems transmit signals, sounds, and motion to communicate with the whole. From the electron of an atom, within a red blood cell, and beyond comes one grain of rhythm in the expansive beach of our existence (Cooper & Andrews, 1975; Wolf, 1962). These rhythms that sustain all fundamental patterns of movement interplay with each other in perfect synchronicity without obstruction. If this was not the case, we as humans could not stand upright, withstand momentum, take air into our lungs, circulate our blood, contemplate, and feel all in the same breath (Todd, 1937). We are as humans, and members of nature, created and sustained in rhythmic synchronicity.

In 1665, a Dutch scientist Christian Huygens performed an experiment in which two pendulum clocks were mounted side by side and each was set in motion. He discovered that the pendulums eventually began to swing together in precise rhythm. Huygens termed this phenomenon "entrainment." He postulated that nature always seeks the most efficient state of energy consumption. In the state of entrainment, it takes less energy to pulse in coordination than in opposition (Leonard, 1978).

This thesis is an attempt to find within ourselves the quality of entrainment, the matching of bodily rhythms in an attempt to create a more fluid, efficient manner of motion. Rhythmic modeling is in essence entrainment of human physical motion.

Humankind may perceive rhythm in four ways. The first is sound, as in the beat of a drum or the cadence of poetic verse. The second is visual, as in the swing of a pendulum or the shape and form of art. The next is tactile, such as feeling one's pulse. Lastly is kinesthetic or, as we say, "muscle sense" (Thompson, 1933).

The muscles of our bodies are the foundations supporting the functioning of ourselves as rhythmic instruments. Musculature was created for movement, and rhythm is in turn movement. It is not possible to imagine rhythm without thinking of the body in motion (Jaques-Dalcroze, 1967).

The realization of the importance rhythm has in relation to our skill and everyday interaction becomes apparent in our language and beliefs. For instance, golfers and batters often lose their "rhythm" and as a result their performances suffer. Human expression creates phrases like, "We are on the same wave length." These manifestations of our human nature testify in support of the realization that rhythmicity is an integral part of our existence.

A fine example of how our rhythmic synchronicity works was discovered by Dr. William S. Condon (1975) of Boston University's School of Medicine. He found that human speech is precisely synchronized with gesture patterns. This motion consisting of both long and short durations follows a common beat: matching syllables, words, and sentences to the movement of the body in a perfect rhythm. Through his studies, Condon concluded that rhythm or time must be viewed as a basic unit in the makeup of human behavior and not just a separate aspect of it.

In all bodily motion, the significant movements of gestures we create with our bodies are labeled as rhythmic. In fact it is claimed that it is impossible to perform a physical act without rhythm. These articulations of motion are indeed identifiable and recordable. In the case of sport, judgment of the ability of an athlete may be made through analyses of these patterns. It has been found that the skilled performer in her or his rhythm is smoother and more efficient in performing a skill in contrast to a novice who struggles with a nonrhythmic quality and coarse motion. The quality of an athlete's performance is expressed in the rhythm of his or her execution (Cooper & Andrews, 1975).

The inquiry into the rhythmic qualities of sport is exemplified by the study done by Cooper and Glassow (1972). In this investigation a tape recorder was used to transcribe the rhythmic patterns of selected sports (e.g., sound of feet hitting the floor). These tapes were in turn translated into musical notation. It was found that, when athletes were asked to replicate the rhythms of recorded patterns of highly skilled athletes, they were able to not only do so quickly but also performed the movement with greater ease and accuracy.

This thesis is a continuation of Cooper and Glassow's inquiry into rhythmic modeling, with the incorporation of accuracy and sensitivity in transposition and analysis of rhythmic performance.

Scope of Problem

The effect of rhythmic modeling on sport skill acquistion was investigated. Forty-six college age physical education gymnastic students attending either a central New York university or college served as subjects. Four sessions divided into instruction, practice, live demonstration, and recording sections were experienced by all subjects during a 2-week period, except for subjects in the practice only group who received a practice, live demonstration, and recording period. Prescriptions for the two treatment groups during the instruction periods included either a videotape of a selected sport maneuver or an audiotape representation of the same skill. Subsequent performances of subjects were translated to graphic form and statistically compared to the model maneuver pattern.

Statement of Problem

The purpose of this study was to investigate the effect of rhythmic modeling on sport skill acquisition.

Null Hypothesis

The following null hypothesis was tested in this investigation: Rhythm and visual modeling will have no effect on gymnastic performance.

Research Hypothesis

The following research hypothesis was tested in this investigation: Rhythmic modeling will enhance gymnastic performance more than visual modeling.

Assumptions of Study

The following assumptions were made for the purpose of this study:

1. All subjects enrolled in their appropriate skill level class (i.e., beginners in beginning class, more advanced in the intermediate class).

2. The subjects were not deficient in interpreting rhythm.

3. The subjects were equally motivated.

Definition of Terms

The following terms were defined for the purpose of this study:

1. Rhythm is manifest in muscle action. It is measured energy and the controlling force that gives form to all muscular action (H'Doubler, 1946).

2. Dalcroze Eurhythmics is a method that expresses in bodily motion all the elements of music, excluding sound. The study of Eurhythmics allows the student to reproduce the rhythm in movement precisely, as though it were written in musical notation. The human body in essence becomes a musical instrument (Rosenstrach, n.d.).

3. Low skilled subjects were those whose skill ability placed them in a beginning physical education gymnastics class.

4. Intermediate skilled subjects were those whose skill ability placed them in an intermediate physical education gymnastics class.

5. Highly skilled performers were those whose skill ability allowed them to participate on a college gymnastics team.

Delimitations of Study

The following were the delimitations of this study:

1. Only college age basic and intermediate gymnastic students were used in this study.

2. Each group of subjects was administered different types of instructional models, except for the practice only group which just practiced the maneuver. All groups received a single live demonstration of the skill they saw or heard in the instruction period (in the case of the treatment groups) and were to execute in the practice and recording sessions. One treatment group received a videotape instruction, the other an audiotape instruction.

3. All maneuvers were transposed to rhythmic graphic notation using Dalcroze Eurhythmic analytical technique.

Limitations of Study

The following were the limitations of this study:

1. The findings related to the types of instructional models utilized. Valid comparisons may only be made if the same instructional models are used.

2. Because of its precision, the findings may only be valid when utilizing Dalcrozian transposition.

Chapter 2

REVIEW OF RELATED LITERATURE

This chapter reviews the features of imitative modeling, rhythmic modeling, and Dalcroze Eurhythmics as an analytical and instructional tool. A summary is also presented.

Imitative Modeling

The term "imitative" modeling refers to the behavior of an individual who has witnessed the action of another. This form of imitation is characterized by the matching of the cues transcribed to the observer by the model and measured by degree of similarity (Gewirtz & Stingle, 1968). Flanders (1968) stated that the investigation into imitative responses is focused upon the relationships between a model's behavior and an observer's behavior.

Bandura (1977) provided the basic definition of modeling and expanded it to express its diverse application in responsive behavior. He stated that an important aspect of modeling is the conveyance of information to observers, not only to create new whole responses into completely original patterns. These responses, however, may not necessarily be in the same form as the model's behavior. Physical representation, pictoral, or verbal descriptions may all act as accurate observer responses.

The form in which the model is conveyed may also vary. Whether a behavior is transmitted through diction, pictures of physical action, or other forms, modeling may occur, although the effectiveness of each mode may vary. For instance, it is sometimes difficult to express with diction the same degree of information that pictoral or physical demonstrations possess (Bandura, 1977). Again, simple exposure to a model does not guarantee that imitation will occur. Exposure to a series of cues by a person does not necessarily mean that she/he will focus on all information presented. A natural selection process will occur, and the person may or may not choose the most significant or correct cues to which he/she is directing attention. Also, it is critical that the tempo, quantity, and complexity of stimuli presented to the observer be taken into account as partial antecedents to the level of observational learning (Bandura, 1977).

Bandura's theory of modeling is comprised of four processes; all of which interact to create imitation and subsequent modeling. The first is the attentional process. This portion of the modeling procedure is based on the fact that individuals cannot learn by observation if they simply do not attend to or comprehend in detail the vital features of the modeled behavior. Factors affecting the attention of an observer may include basic personal characteristics, the ability of the individual to process information from past experience, the highlights of a modeled behavior, and the organization of the interaction between model and observer. Also partially affecting the speed and sophistication of modeling are the characteristics of the observed behavior, its salience, and structural makeup (Bandura, 1977).

Motivation may be included as a factor acting upon the ability of an observer to accurately perceive a model. Not observing significant cues, inaccurate coding of observed behaviors for memory encoding, inability to retain what is observed, lack of physical ability, and insufficient incentives may also play an important role in the success of the imitative process (Bandura, 1977). As this social learning theory suggests, reinforcement aids more as an antecedent rather than a consequent influence. Expected benefits, therefore, can heighten the retention of what has been imitated by motivating the observer to code and rehearse the observed action, which is seen as highly beneficial.

The basic tenet supporting the retention process of Bandura's modeling theory is simply that a person cannot be affected by an observation of a modeled action if it is not remembered. If an individual is to recreate an action previously observed, which is no longer available for referral, the response components must be stored in memory in symbolic form. After observed behaviors have been transposed into images and easily recruited verbal representations, the memory system can operate as a template for future reproduction of imitative responses. Because images and verbal representaions hold within themselves such a large amount of information in a readily stored and recalled format, such a memory system is vital for acquistion and retention of all observed modeled behaviors (Bandura & Jeffery, 1973).

Pribram (1977) claimed that memory storage is composed of a rhythmic process utilizing wave patterns. Physical skills are translated into wave patterns, both spatial and temporal, and are then stored in the brain. The mind is then capable of interpreting these wave forms through a fast Fourier transformation. To reproduce a desired skill, the mind must recreate the precise rhythmic wave pattern that represents the physical maneuver. Therefore, the accuracy of the brain to create and interpret wave forms of corresponding physical performances is vital for accurate recreation of skilled action.

Gerst (1971) related the belief that, during pre- and postexposure periods to a stimulus, the observer arranges the experienced events into symbolic schemes. These schemes are then organized, with the significant cues placed in familiar, more easily attainable forms. After observed skills have been translated into images or verbal configurations for memory simulation, they act as mnemonic aids by serving as catalysts for reaction retrieval and reproduction in later situations.

It is believed that the accuracy of memory coding is created by the fact that it allows the observer to arrange complex sensory information into understandable, vivid, and easily retrievable verbal codes. As a result, responses to modeling can easily be kept in this form and later utilized to reproduce the correct response (Gerst, 1971).

Rehearsal of an observed behavior is also vital in aiding the retrieval of stored information from memory. For instance, throughout a practice session action patterns may be arranged and coded into mnemonic patterns created to aid in recall. It is also believed that repeated practice may enhance retention by both increasing and reinforcing the number of memory traces (Bandura & Jeffery, 1973).

There is difficulty in this memory procedure if these codes are not rehearsed when fresh in an individual's memory. This causes the response information to deteriorate, resulting in faulty imitative skills. A feature of the memory/rehearsal system is expressed when delayed rehearsal occurs in any manner, but retention decay is not affected. But, when immediate rehearsal is used, an enhancing effect can be seen in delayed response reproduction (Bandura & Jeffery, 1973).

Motor reproduction is viewed by Bandura (1977) as an important feature of modeling behavior. Motor reproduction is created by arranging reactions to behavior spatially and temporally in sychronicity with the modeled templates. The ideas leading to these reactions are not easily reconstructed into correct action without mistakes made on the initial trials. Accurate coordination with the modeled behavior is most times created by adjustments made with an attempt to correct errors in these early actions. Mismatching between a person's symbolic representation and his/her physical attempt at the skill creates cues upon which to draw for future corrective adjustments. Complicated action often creates for the observer problems in simple examination. Many persons performing sport skills, for example, must respond to ambiguous kinesthetic cues or verbal hints from colleagues. It is, therefore, believed that skills are not made flawless through mere examination; they also are not created only by hit-and-miss execution (Bandura, 1977).

It is, therefore, thought that in everyday learning a person may approximate a desired behavior by modeling. But, only by reconditioning one's behavior through self-correction procedures may the feedback from execution be useful in conjunction with observation of the modeled skill (Bandura, 1977).

A project by Jeffery (1976) supported the opinion that motor rehearsal is an important facet of the modeling process. In this study, subjects who practiced the modeled behaviors symbolically, either alone or with physical practice, recreated observed patterns more precisely than those subjects who practiced physically or had no form of practice. But, the study also indicated that physical practice increased the speed of performance of simple skills but did not improve imitation beyond only observation of a particular skill. The overall results of this study were seen as supportive of Bandura's social learning theory, namely that modeled skills are best learned when the behavior observed is first arranged symbolically and then continuously corrected in accordance with execution feedback cues.

<u>Rhythmic Modeling</u>

"Motor rhythm, as distinguished from other forms of orderly action, may be defined as a progression in action by balance deviations in time, intensity, or quality from the simple periodicity of any regular recurrent action" (Seashore, 1927 p. 142). This early definition best represents the focus in which physical rhythm is viewed within this study.

Cooper and Glassow (1972) investigated the rhythmic patterns of specific sport skills. This investigation focused on the transcription and subsequent adherence of skilled sport rhythmic patterns by novice performers. The investigators utilized a tape recorder to capture the rhythmic patterns of specific sport skills. Beginning athletes were then asked to replicate these rhythms recorded by outstanding athletes. The results were noteworthy, in that novices quickly and accurately learned to achieve the movements accurately.

In all sport the articulations we make with our bodies or held devices are easily identified. In most cases judgment of the skill level of a performer can be made by analyzing these patterns. The reason behind this method is that outstanding performers often create slightly different articulations than do average or novice performers. Many athletes and coaches can distinguish by sound and pattern a performer's movement and how skilled that individual may be. The efficiency of athletes' executions are transmitted through the rhythmicity of their maneuvers (Cooper & Andrews, 1975).

Human movement may be represented by rhythmic notation, which provides a linguistic representation from which to investigate. It is important to note that many rhythms that are transposed from sport skills are often not even in beat structure. Although these rhythms are uneven, the actual pattern of repeated execution is consistent. It is significant that most athletes do not recognize their own rhythms and most likely only subconsciously realize their own best rhythmic patterns (Cooper & Andrews, 1975).

Cooper and Glassow (1972) review rhythm found in sport with the following points supported by their investigation:

1. Every athlete has a particular rhythm all her/his own.

2. Each portion of every performer's body has a rhythm all its own.

3. The total rhythm of movement is difficult to record.

4. In some skills, the strategy to gain an edge is to "feel" the rhythm of the opponent.

5. The rhythm of an athlete is not uniform and consistent in tempo.

6. Often the tempo of the maneuver is the single most distinguishing point in comparing skilled performers with unskilled performers.

7. Most athletes only subconsciously realize what their rhythmic patterns are.

8. There apparently exists for everyone a rhythmic pattern that is best for that particular person to

utilize, and this template may possibly be the choice for all athletes to use.

9. As we find finer and acute methods to execute skills, it may be possible to recreate various rhythmic templates from the performances of elite performers.

Observable sport patterns, exemplified by human motion, may be transposed to aid in the study of sport execution. The findings of these examinations may create strategies on how to utilize such patterns in the acquisition of sport skills. Supporting such strategies is the fact that similarities between rhythms of elite performers in a particular sport are far more prevalent than their differences (Cooper & Andrews, 1975).

Knott and Voss (1969) reported that rhythmic timing of verbal cues and auditory rhythmic patterns of music may enhance rhythmic execution of physical activities. In their investigation the result of auditory rhythms on muscle activity was observed with the use of electromyography (EMG). Both even or "smooth" rhythmic patterns created marked decreased contrasts in the EMG pattern, whereas the uneven or "rough" version of the rhythmic pattern created a significant increase in deviation from the normal EMG pattern. This development of variation was apparently created from the uneven form of the rhythmic pattern. It was found that motor skills executed to these rhythmic templates elicited subjects'

EMG patterns characteristic and typical of untrained subjects as they gain coordination.

A study of individual difference relating to physical patterns of bodily movement was done by Grose (1969). In this investigation subjects performed two coincident timing tasks, one a horizontal arm movement and the other a whole body movement. An inquiry into the progressive motion involved in the execution of the motor tasks revealed no recognizable aspects related to the success of the task. The results showed that neither limb motion nor whole body skills contained any coincidental aspects of the pattern, and neither were related to the success in comparative timing. The ability to perform in a rhythmic manner, as much as it could be indicated by the data reviewed, was uncorrelated with the coincidence of timing success. Tempo of a specific step in a series of movements was also uncorrelated with this success. The dissociation in the results was viewed by the investigators as due to individual difference and not the testing procedures utilized.

Haight (1944) investigated individual differences in response to rhythmic stimuli. Motor adaptation using walking as the form of physical maneuver was studied. Walking was well chosen because the action is a natural, automatic movement and does not cause problems in coordination. In the study subjects were asked to adapt their walking step to an objective rhythm pattern. Haight believed that individuals, after having experienced a rhythmic pattern and proceeded to synchronize with it, could not in fact maintain the harmonious rhythm without forming a personal pattern. In essence, the subjects created a variation of the rhythmic pattern presented. The results suggested that the magnitude of individual differences was so large that the problem must be met by an individual approach. Haight also stated that a greater number or cases should be tested before any final judgment is made.

Schwand (1969) conducted an investigation designed to study certain spatial and temporal features of movement. Subjects were given the rhythm test from the Drake Musical Aptitude Tests. From these results 10 high and 10 low level rhythmic ability subjects were chosen and were filmed executing a rhythmic maneuver. The task was performed to a fixed rhythmic rate of 66 bpm and included a forward lunge with a forward arm swing, with the objective being to bring the hand directly in line with a target.

Deviations in time and space were assessed by frame-by-frame analysis of the filmed maneuver. It was observed that the means of the absolute deviations in time and space of both high and low performers of the Drake Rhythm Test were similar. Neither the high nor low rhythmic ability group was more accurate than the other in interpreting intervals of time or space in such a manner as to be able to stop in a specific point in space and time.

Smoll (1975) conducted a study of preferred tempo in the performance of repetitive movements. Both within and between subject variability were investigated. Male and female subjects executed a series of arm swings at a tempo chosen by themselves. This maneuver consisted of swinging the arm forward from a vertical starting position. The arm was swung forward until a target line was met. Subjects then returned their arms to the vertical starting position. Deviations between subjects' chosen tempos of execution were significantly greater than the degree of variation in subjects' motor response times. Results indicated that individuals possess preferred tempos of voluntary motion, which differ from others.

An investigation into auditory and visual perceptions of rhythm by performers skilled in selected motor activities was performed by Huff (1972). This study investigated differences in both auditory and visual rhythmic perception. Athletes participating in basketball, tennis, swimming, and modern dance varied significantly in their rhythmic imitative skills, revealing differences in adaptive syncronicity in accordance to both auditory and visual patterns.

Decisions of whether ability to perceive and react to auditory and visual rhythms had any relationship toward gender and/or prior experience in music and dance were made. Measures of rhythmic sensitivity were tested by utilizing the rhythm section of the Seashore Measures of Musical Talent examination and also by measuring and evaluating deviations that occurred in repeated simple gross motor maneuvers performed in attempted synchronicity with recurring audio and visual patterns.

The results of the study were as follows:

1. Greater deviations were found in visual rather than auditory rhythmic perception.

2. Dancers and athletes did not appear to possess a greater ability to perceive both types of rhythm as compared to the control group.

3. Advanced dancers, swimmers, tennis players, and a combined group of skilled athletes executed significantly better than the control group when given tests of motor reactions to either type of rhythm.

4. Dancers were more accurate in response to auditory rhythms than basketball players, who in fact did not deviate significantly from the control group in any of the rhythmic measures.

5. All groups' motor responses resulted in extreme accuracy.

6. There was no evidence that past experience in either music or dance had any effect on rhythmic perception or performance.

Dalcroze Eurhythmics

Emile Jaques-Dalcroze was a popular Swiss composer, who began as an educator in 1891 at the Geneva Conservatory, Swizterland. This talented musician began a movement to educate not only the mind but the body as well, after realizing that his students fell short in their listening skill as musicians. He realized that people have a natural physical response to music and began a quest to incorporate this phenomenon into his teaching. His foundation was built on the ancient Greek belief that music and movement are the same and may not be separated. Thus, one objective of this Dalcroze method is

> for the precise physical execution of a rhythm, it is not enough to have grasped it intellectually and to possess a muscular system capable of interpreting it; in addition and before all else, communications should be established between the mind that conceives and analyses and the body that executes. (Jaques-Dalcroze, 1967 p. 61)

Eurhythmics (translated as "good rhythm") is an approach and method of musical education. It develops concurrently the sense of hearing, the sensitivity to tone and harmony, the propensity for rhythm, and the pursuit of synchronicity. With the utilization of a repertoire of exercises that develop flexibility and the regulation of bodily motion in space. time, and energy, the sense of hearing is developed to a level of realization where it effects the intellect and instinct of the individual and in turn enhances vocal and instrumental interpretation. The physical body, consisting of nervous and muscular components, becomes controlled in harmony, and as a result the intellect creates a balance between instinctive and voluntary controlled movements (Jaques-Dalcroze, 1967). Although one might believe that musical education and physical education are far removed from each other, there is in fact very little distinction. The musician, for instance, focuses his or her attention on perfecting the motion of the finer muscles of the upper body, including the vocal chords. The musician is usually stationary and checks her or his performance mainly with the auditory system. The athlete concentrates mostly on the larger muscle groups of the leg, trunk, and arm. The athlete is almost continuously in motion and checks his or her performance with visual perception (Wilson, 1981). So, indeed parallels may be seen between Dalcroze education and physical education. This is apparent when we define physical education's greatest contribution as a desire for good bodily motion in coordination and cooperation with the structure of the human body and its kinesthetic and biological laws. All bodily motion, therefore, may be defined as good if it is coordinated and controlled within the realm of efficient use of energy and if the outcome is specific physical execution.

When analyzing a sport skill being learned by a student, the difference between uncoordinated motion of the beginning attempts and the smoothness and efficiency of later more advanced motion is the timing and intensity of the significant occurrences in the entire movement. The rhythm of the movement changes from an inefficient to an efficient one (H'Doubler, 1946).

Dalcroze education is based on the following five principles which are:

1. Theory follows practice.
2. Listening--The basis of music education.
3. Time plus space plus energy.
4. Self-expresion--The aim of euryhthmics.
5. Joy--Unity of body, mind, and spirit.

The fourth, "time plus space plus energy," encourages balance in coordinated movements and gestures. At its essence it is the elimination of useless movement. A student learns to move in harmony without consciously thinking of the smoothness of the motion. This "learned instinctiveness" allows the student to use only the muscle groups needed for precise, smooth, and harmonious motion.

The student loses nonrhythmic imbalance and acquires a state of true balance (Rosenstrach, n.d.).

Dalcroze Eurhythmics cannot be judged by the observer. It is a personal experience that manifests itself in precise, harmonious muscle and nervous control, awakening the mind to creative potential. Although Eurhythmics is at its core musical education, it has been applied to education in the areas of dance, theater, opera, physical education, and in the therapy of mentally and physically handicapped children.

A study by Painter (1966) investigated the effects of a rhythmic and sensory motor program on perceptual motor spatial abilities of kindergarten children. In this program the children partook in the following nine skills: (a) visual dynamics, having the child see a movement pattern then replicating the pattern: (b) dynamic balance, having the child practice balance movements on both sides of the body: (c) spatial awareness, having the child become aware of one's body in space in relation to a reference point: (d) tactile dynamics, feeling objects in the environment and moving with or in relation to them: (e) body awareness, the identification and localization of the child's own body parts: (f) rhythm, moving to easily defined auditory rhythmic patterns, (g) flexibility, experiencing changes in tempo, movement patterns, and mood swings; and (h) unilateral and bilateral movement, moving one or two sides of the body.

The conclusions made by the author were that a systematic program of sensory and rhythmic motor activity did increase the level of ability in (a) drawing a human figure, (b) clearing distortion of a child's body image concept, (c) visual motor integrity, (d) sensory motor spatial performance abilities, and (e) psycholinguistic skills.

Another investigation utilized Dalcroze Eurhythmics and an integrated physical education program to enhance childhood perceptual motor performance. Brown, Sherrill, and Gench (1981) hypothesized that proprioceptive, visual, and auditory functioning are related to comprehension and recognition of the body, self, space, time, force, and flow. They stated that past preschool music education programs have used bodily motion to attain their goals. Physical education programs on the other hand have been successfully enhanced by music. Thus, a hybrid approach consisting of components from both types of programs to facilitate perceptual-motor development seemed a plausible educational approach. Thus, Dalcroze Eurhythmics, a program of rhythmic exercises utilized to develop the natural rhythms of the body, while educating the student in the economy and precision of movement, would seem applicable as a method of instruction to be used as a music/physical learning tool.

The results revealed that an integrated physical education/music program based upon Dalcroze concepts was more effective in enhancing the motor, auditory, and language aspects of perceptual motor performance than was a basic movement exploration, self-testing program using teacher-child conversation, singing, and review of the same basic body movement patterns every day. Thus, the results of this study support the integration of music and rhythm into all areas of physical education programs rather than their utilization as separate entities (Brown et al., 1981).

Summary

Imitative modeling conveys information to an observer or observers by presenting representations in the form of physical, pictoral, or verbal models. The observer then is able to create new and or modified patterns of behavior (Bandura, 1977). Bandura's theory of modeling is created from four processes, all of which are vital for the creation of imitation and modeling. These processes are attention, motivation, retention, and rehearsal, all of which interact to aid or hinder the imitative procedure in the observation of a model behavior.

Rhythmic modeling is a phenomenon by which athletes may imitate the skilled rhythmic patterns of elite athletes and, by these observations, come to perform the skill with more precision and harmony. This form of modeling is possible because of the qualities that all human movement possesses. All movement may be translated into rhythmic representation that then can be examined or compared with other rhythms. These patterns transmit the efficiency of an athlete's execution through the rhythmicity of their maneuvers (Cooper & Andrews, 1975).

The majority of rhythm studies reviewed support no necessary relationship between level of rhythmic ability and rhythmic imitation skill. Also supported is the ability of individuals to maintain their own natural rhythms, rather than adhering to imposed ones.

Dalcroze Eurhythmics is a method of musical education that develops hearing, the sensitivity to tone and harmony, and the propensity for rhythm and achievement of synchronicity (Jaques-Dalcroze, 1967). Dalcroze education is based upon the principle of "time plus space plus energy," which encourages balance in equal movements and gestation. It encourages the elimination of useless movement and the development of efficient bodily gesture (Rosenstrach, n.d.). Studies involving Dalcroze Eurhythmics as a teaching technique show positive results in such areas as sensory motor performance and psycholinguistic skills.

Chapter 3

METHODS AND PROCEDURES

This chapter describes the selection of subjects, method of transposing sport skill rhythms into musical and graphic notation, administration of instructional model types; method of data collection, transposition of data, and treatment of data. A summary of the methods and procedures is also included.

Selection of Subjects

The subjects in this investigation were 46 college age physical education basic and intermediate gymnastics students attending either a central New York university or college. Subjects were divided into three groups using existing class sections, two of which experienced a different instructional mode of a gymnastic skill. Each subject's permission to participate in the investigation was obtained by the use of an informed consent form (Appendix A). Only subjects who participated throughout the entire study were used for data analysis. Twenty-four subjects attended all four class sessions and, in turn, their data remained valuable for transposition and computation.

Rhythmic Transposition of Filmed Maneuver

Past transpositions of rhythmic skill have only focused on the patterns produced when there is body-object contact (Cooper & Glassow, 1972). In analyzing a maneuver, be it dance, gesture, or any bodily motion through space, there exists not only the rhythmic patterns produced by physical contact but other significant points of rhythmicity, included in the motion of the individual. Utilizing Dalcroze Eurhythmic techniques of rhythmic analysis, it is possible to accurately transpose not only the basic patterns of physical contact during the performance of a desired skill but also detect and record other significant points of motion in space that occur with the execution of the skill. All of this is vital for any accurate performance.

For both the skilled model and all subjects' maneuvers, transpositions to graphic representation were created. By viewing each individual's performance, it was possible to notate the rhythmicity of the chosen gymnastic skill, a double cartwheel followed by a backward roll. The musical notation of a double cartwheel followed by a backward roll is as follows:

It was most important to standardize each person's tempo so that it could be matched against the model rhythm. The nature of rhythmic sequences are such that, although the tempo of the rhythm may be different, the pattern may be exactly the same. Individual difference, skill level, and body type will cause variations in the tempo of a performed skill across subjects (Driver, 1936; H'Doubler, 1946).

This notation was then transferred and utilized in graphic notation for accurate data analysis, which can be found in Figure 1.

<u>Administration of Instruction Models</u>

Each experimental group was given the respective prescription for 5 min. One treatment group listened to a rhythmic representation of the sport skill, in this instance a double cartwheel followed by a backward roll. This representation consisted of an audio cassette recording created from the Dalcroze Eurhythmic analysis representing the executed maneuver. The other treatment group watched a videotape of various skilled performers executing the same maneuver. This videotape consisted of skilled performers filmed at diverse angles executing the maneuver repeatedly over a 5-min period. The practice only group was asked to physically practice this skill during a 5-min period. Prescription groups were given a brief live demonstration after the initial instruction period. The practice only group also received the brief live demonstration. This procedure was repeated over the 2-week period of instruction. Each group (except for the practice only group who received only the live demonstration and practice session over four sessions) experienced four sessions of instruction with practice and filming subsections. After a brief demonstration, the instruction subsection lasted 5 min, the practice subsection 5 min, and the filming

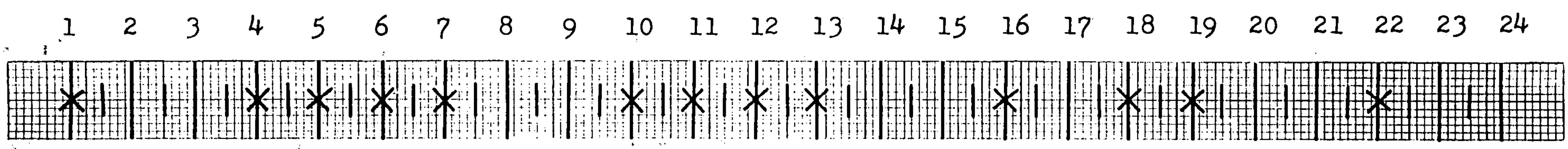

Figure 1. Graphic representation of skilled rhythmic pattern.

subsection 5 min. All sessions, therefore, lasted approximately 15 min, except the practice only group which lacked the 5-min instruction period. Directions read to all subjects before the commencement of the study can be found in Appendix B.

Method of Data Collection

Subject performance was recorded after the instruction and practice periods. Using a video cassette recorder, each subject's performances of a double cartwheel followed by a backward roll was recorded. Each subject was given the option to perform the maneuver twice. This ensured both the best performance by the subject by providing a second opportunity for satisfactory execution of the maneuver. Subject identification on film was by subject number only, ensuring confidentiality. After all transposition of film was complete, the tapes were erased.

Treatment of Data

Deviations from the model rhythm were assessed by subtracting corresponding values of the model rhythm patterns from the values of the trial rhythm patterns. The representative values of the model rhythmic pattern were 1, 4, 5, 6, 7, 10, 11, 12, 13, 16, 18, 19, and 22. Resulting summed absolute deviations from the template were then analysed with ANCOVA test procedures in the SPSS-X computer program series. Results expressed group, day, and group x day differences.

Summary

The subjects in this study were 46 college age basic and intermediate gymnastic students either attending a central New York universtiy or college. Test subjects were divided into three groups: a practice only group and two treatment groups who were administered a different form of rhythmic representation of a specific gymnastic skill. All groups were given a single live demonstration of the gymnastic skill after the instructional presentation (in the case of the treatment groups). The single live demonstration served as the only instruction given the practice only group. The subjects then practiced the skill represented by the instructional model and demonstration. Directly afterward, the subjects' maneuvers were recorded on videotape. The instruction, practice, and recording sessions occurred in approximately a 15-min time span, with instruction and practice sections lasting approximately 5 min each. The videotape of each subject's maneuver was then transposed to a graphic representation that was adjusted for tempo differences. These patterns were then matched against the original rhythmic model pattern. Statistical adherence to the model pattern by the subjects' successive four performances was assessed.

Chapter 4

ANALYSIS OF DATA

This chapter presents and interprets the results of the statistical analysis of data from this study on the effects of rhythmic modeling on sport skill acquistion.

Analysis of Covariance

ANCOVA was performed on collected data, with Day 1 defined as the covariate in case pretest bias occurred between groups. ANCOVA suggested that no significant rhythmic modeling occurred, thus the research hypothesis was rejected. ANCOVA resulted in a nonsignificant group effect, $F(2, 20) = 0.53$, $p > .05$, and a nonsignificant day effect, $F(2, 42) = 0.31$, $p > .05$. The nonsignificant group x day effect, $F(4, 42) = 0.38$, $p > .05$, suggested no significant group x day results. These results can be found in Table 1.

By viewing collected data found in Table 2 in an individualistic manner, noteworthy trends do appear. In Table 2, values higher than zero indicate the degree to which an individual deviated from the model rhythm. In the practice only group, only one individual showed a learning trend. In Group 2, the video instructed group, only one individual showed a learning trend. In Group 3, the audio rhythm group, five individuals showed a learning trend. One of these individuals in the audio rhythm group

Table 1

ANCOVA of Gymnastic Performance

Source of Variation	*df*	*MS*	*F*
Group	2, 20	38.44	0.53
Day	2, 42	14.67	0.31
Group x Day	4, 42	18.30	0.38

Table 2

Values for Individual Subject Performance by Day and Group

Group	Subject	Day 1	Day 2	Day 3	Day 4
Control	1	13.50	0.00*	0.00*	12.00
	2	0.40	0.00*	0.00*	8.00
	3	1.00	0.00*	0.00*	0.00*
	4	13.10	2.40	4.00	12.00
	5	15.30	0.00*	11.00	4.00
	6	43.50	27.40	10.40	8.00
Visual	1	27.00	6.60	4.00	19.60
	2	31.00	13.80	6.00	10.00
	3	3.20	24.00	9.70	4.00
	4	32.40	8.10	23.40	20.00
	5	40.90	12.20	0.00*	0.00*

(table continues)

Group	Subject	Day 1	Day 2	Day 3	Day 4
Audio	1	22.60	6.80	2.40	12.00
	2	5.40	0.60	5.00	20.00
	3	17.00	16.00	15.80	4.00
	4	13.00	1.00	3.00	3.00
	5	0.40	0.60	0.00*	0.00*
	6	32.10	1.00	12.00	9.00
	7	16.80	1.10	8.00	12.00
	8	19.80	13.00	8.00	18.00
	9	32.10	19.30	4.00	4.00
	10	35.10	19.20	23.80	8.00
	11	16.10	5.00	0.00*	0.00*
	12	0.00*	0.00*	0.00*	0.00*
	13	1.30	14.00	24.00	6.00

*Indicates perfect match with model rhythm.

maintained a mean of zero throughout the 4 days which indicated a perfect rhythmic match with the model rhythm.

Summary

The results of the ANCOVA suggest that no significant rhythmic modeling occurred among prescription groups. Group, day, and group x day effect results led to the rejection of the research hypothesis. Individual mean trends in some cases implied possible learning progressions, although there existed no significant statistical support. Thus, the results of this study suggest that rhythm and visual modeling had no effect on the acquisition of a gymnastic skill.

Chapter 5

DISCUSSION OF RESULTS

In this chapter, the results of this investigation, which measured the effects of rhythmic modeling on sport skill acquisition, will be discussed.

Interpretation of Imitative Results

The results of this investigation suggest that rhythmic modeling does not occur from ordinary model/observer interaction, be it experienced through a visual or auditory medium. The complications this study underwent in supporting the research hypothesis can likely be attributed to problems of attention, motivation, and individual differences.

The subjects in this study participated in their respective sessions during a 4-day series extending over a 2-week period. It is possible that the instructional material presented either was not attended to correctly, or the qualities possessed by the models led to improper attention by the subjects, or individual difference made group comparison questionable.

Bandura (1977) stated that the attentional process is one of the four vital processes that are crucial to the imitation and modeling of an observed behavior. Subjects participating in this study could not have learned by observation if they did not attend to or clearly perceive clearly the instructional models presented to them.

Factors affecting attention include (a) personal characteristics, (b) ability of the individual to process information from past experience, (c) highlights of the modeled behavior, (d) organization of the interaction between model and observer, and (e) salience and structural makeup of the observed behavior.

First, personal characteristics may have affected subject attention by not allowing all subjects to select the most relevant cues of the instructional model. A natural selection process occurs among all individuals, therefore it is possible that each subject may or may not have chosen the most crucial or correct cues. So, in this instance, it is not overall attention that is questioned, but rather the specific attention directed toward the many significant cues of the observed model.

Second, the ability of the individual to process information from past experience is another inherent factor possibly not allowing subjects to attend properly. By not reflecting upon past observation and, therefore not building upon past experience as an aid for identification of subsequent notable cues, subjects may have viewed models in a manner simulating a new experience in each episode the model was presented. Subjects must apply past cues deemed significant to aid in the observation of future material presented.

Third, highlights of the modeled behavior can be seen as affecting observer attention. If the model presented does not possess cues the observer may identify, optimum attention and subsequent imitation may fall short. It is not that the individual is not paying proper attention to the model, the problem exists in the model not providing distinct cues for suitable observation. The highlights of the two instructional models presented in this study may have fallen short of providing maximum imitative cues.

Fourth, interaction between model and observer may have caused subjects not to give optimum attention. By not providing proper interaction between model and observer, a breakdown in association may have occurred. Subjects not viewing themselves as involved with the model presented may in turn remove themselves from the material presented and, thus, not attend to the model as attentively as a subject who related to the model. In this study the subjects were passive observers, either viewing a video or audio representation of the model. The amount of interaction between model and observer in this study was minimal.

Fifth, similar to the highlights of the modeled behavior, basic characteristics, salience, and structural makeup may also affect observer attention. Because of this, diminishing effects upon the speed and degree of imitation may also be observed. For instance, if the observer views the model as too complex, association with the model will be minimal, thus causing little reason to be attentive. Also, the model may be too advanced for any particular subject's cognitive ability and, therefore, proper attention to the relevant cues may be reduced.

Bandura (1977) stated that motivation may also be considered as a factor affecting the ability of an observer to correctly perceive a model. Such factors as lack of physical ability and insufficient incentives may affect the success of the imitative process. If the subject is discouraged by personal performances that are perceived as unsuccessful, then motivation will most likely be affected. Also, if the observer cannot see any realistic benefits of the observer/model, then interaction motivation will be greatly diminished.

Other factors, namely retention and physical practice, delineated by Bandura (1977), are not viewed as having ill effects upon this study. Individuals in this study were assumed to be healthy and capable of normal memory functions. Also, sufficient physical practice was experienced by subjects in all groups, and cannot be considered as a factor diminishing the imitative process.

The other probable cause for the rejection of the research hypothesis is that of individual differences. Variation between individuals is often so great that, when grouped for common characteristics, personal deviations or performance inconsistencies are too large to justify group comparison. Although a study by Cooper and Glassow (1972) supported the idea that rhythmic modeling may occur, studies by Grose (1969), Haight (1944), and Smoll (1975) support a different finding. They suggest that individual differences may make the justified comparisons of personal rhythmic characterictics impossible, and that this problem must be met in an individualistic manner. Because rhythm is seen as a personal characteristic, and the design of this study unfortunately does not account for individual differences, the results of this study support the premise that the comparison between individual performance is unjustified and, therefore, inaccurate. Thus, this study supports the findings of Grose (1969), Haight (1944), and Smoll (1975).

Thus, personal rhythmic qualities may be such that comparison and possible enhancement must be made in an individualistic manner. Interaction with rhythmic exercises and models may only enhance personal rhythmic characteristics, which in turn cannot be justifiably compared to other persons. In essence, through rhythmic experience and internal adjustments based upon these experiences, individuals may become more efficient in their own rhythmic ability and may acquire proficient rhythmic patterns of physical movement.

Summary

The probable reasons supporting the null hypothesis are (a) lack of attention, (b) inadequate motivation, and (c) individual differences.

Attention was considered affected by factors such as personal characteristics, ability of the individual to process information from past experience, cues from the observed behavior, organization of the interaction between model and observer, and the characteristics of the observed behavior, particularly its salience and structural makeup.

Motivation may have been compromised by such factors as lack of physical ability and the absence of expected benefits by subjects. Subjects either falling short in physical abilty or expectations of enhanced performance may in turn become disinterested in the model being presented to them.

The majority of studies reviewed in this investigation support the premise that rhythmicity is strictly individualized. This study and the studies of individual differences reviewed support the belief that individual differences must be taken into account when personal characteristics such as rhythmicity are being compared. Individual rhythmic movement, therefore, must be studied in such a manner as to account for personal deviation. This investigation, therefore, and the study upon which it is based, namely that of Cooper & Glassow (1972), may be scrutinized as not adequately taking into consideration individual differences among subjects.

Chapter 6

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS FOR FURTHER STUDY

Summary

The effects of rhythmic modeling on sport skill acquisition were investigated. Four sessions divided into instruction, practice, live demonstration, and recording sections were experienced by all subjects during a 2-week period, except for subjects in the practice only group who received a practice, live demonstration, and recording period. Forty-six college age physical education students attending either a central New York universtiy or college served as subjects. Prescriptions for the two treatment groups during the instruction periods included either a videotape of a selected sport maneuver or an audiotape representation of the same skill. Subsequent performances of subjects were translated to graphic form by utilizing Dalcroze Eurhythmic analysis, and performances were then statistically compared to the model maneuver pattern.

The results of the ANCOVA suggested that no significant rhythmic or visual modeling occurred among prescription groups. Group, day, and group x day data results supported the rejection of the research hypothesis. Individual means in some instances indicated possible learning trends, although there existed no supporting statistical data. Thus, the null hypothesis was supported by the statistical analysis performed on collected data for group, day and group x day effects.

Conclusions

On the basis of the findings, the following conclusion is warranted: Rhythm and visual modeling, when participated in for 15-min sessions divided into instruction, practice, live demonstration, and recording subsections extending over a 2-week period, are ineffective in enhancing gymnastic performance. Therefore, within the limits of this investigation, rhythm and visual modeling have no effect on gymnastic performance.

Recommendations for Further Study

The following recommendations are offered for further investigation:

1. Enhance the same basic instructional format.
2. Utilize the same Dalcrozian analytical format.
3. Include a greater number of subjects in the study.
4. Shorten the number of instruction periods.
5. Shorten the length of instructional models.
6. Create an individual based research design.

Appendix A

INFORMED CONSENT FORM

(For subjects)

1. a) Purpose of the Study. To determine the effects of modeling on sport skill acquisition.

b) Benefits. To gain information about the effect modeling has on mastering sport skills. To aid in the development of gymnastics and other sport skills.

2. Method. You will be asked to attend your normal physical education class for 2 weeks. Any absence of a participating subject will jeopardize the validity of this study. The group of subjects will be divided using existing class sections, each of which will observe different models of instruction of a gymnastic skill. Total concentration is asked throughout this short period of instruction. After the instruction period and a brief live demonstration of the same skill, you will be asked to physically practice the maneuver that has been displayed. This maneuver, a double cartwheel followed by a backward roll will be rehearsed during a practice period lasting approximately 5-min. Finally, your maneuver will be recorded by a video cassette recorder. This procedure will be repeated in four class periods, throughout a 2-week duration.

3. Will this hurt? No physical or psychological risks are evident outside the normal realm of a physical education gymnastics class.

4. Need more information? Additional information can be obtained form either Douglas Walker (273-2815) or Dr. Craig Fisher (274-3112). All questions are welcome and will be answered.

5. Withdrawal from the study. Participation is voluntary. You are free to withdraw your consent and discontinue at anytime. There will be no penalty if you choose to withdraw from the study.

6. Will the data be maintained in confidence? All data will be confidential. Once all taping is complete, only persons involved in analysis of the film will be allowed

access. After analysis the tape will be erased. Identification on film will be by subject number only.

7. I have read the above and I understand its contents and I agree to participate in the study. I acknowledge that I am 18 years of age or older.

____________________ ____________________

Signature Date

Appendix B

DIRECTIONS FOR SUBJECTS

During the first phase of your experimental session you will be asked to attend to a model presented to the group. It is important that you concentrate exclusively on the material being presented. Because the model is presented in a short duration, it is most crucial that you absorb all content included in the model. Relax and concentrate.

The model presented in the first part of this session is a representation of a specific gymnastic maneuver, a double cartwheel followed by a backward roll. It is most important that you keep in mind the model presented to you during the first phase. You will be allowed approximately 5 min to practice this maneuver.

After this brief practice session you will be asked to demonstrate your maneuver. During this demonstration you will be filmed with a video cassette recorder. If you feel that your demonstration was greatly flawed, you will be allowed to attempt the skill once more. Again it is important that you keep in mind the model presented in the beginning of the session. Again relax and concentrate.

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