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Effects of self-modeling on batting performance

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EFFECTS OF SELF-MODELING
ON BATTING PERFORMANCE

by

Michael A. Simon

An abstract
of a thesis 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

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Thesis Advisor: Dr. A. Craig Fisher

ABSTRACT

The effect of a self-modeling video plus batting practice program on teaching baseball players to hit from the nondominant side was investigated with 9 male subjects. Three randomly assigned participants practiced batting only, 3 watched self-modeling videos only, and 3 viewed videos and participated in batting practice. The self-modeling videos portrayed subjects' best swings in a repetitive format. All subjects participated in five treatment sessions with respect to their given group. Batting performance, as measured by the product of the swing at a pitched ball, served as the dependent variable. In addition, electromyography recordings of three major upper body muscle groups were obtained in order to assess whether neuromuscular learning (Engelhorn, 1979) was evident after subjects participated in their respective treatment programs. Means and standard deviations of batting performance were reported in order to determine program efficacy of the three groups. Eight of the 9 subjects increased their batting scores. The batting practice only group displayed the greatest amount of change. The mean differences for the batting practice plus video and video only groups were identical, however, the results of the batting practice plus video group were more consistent across subjects. EMG results indicated that subjects' nondominant side temporal sequences were patterned after their dominant side counterparts. Possible explanations of the results are discussed in terms of the quality of the video-viewing process and the task at hand.

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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

by
Michael A. Simon
May 1988

Ithaca College

School of Health, Physical Education, and Recreation

Ithaca College

CERTIFICATE OF APPROVAL

MASTER OF SCIENCE THESIS

This is to certify that the Master of Science Thesis of

Michael A. Simon

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

The science of hitting a baseball has been a subject of serious inquiry and application for many years (Lau, 1979), and a majority of the participating theorists have, themselves, been reknowned for their accomplishments on the field: Paul Waner, George Sisler, Ralph Kiner, and Ted Williams, to name a few. It is apparent, however, that the theorists in the past have studied and related hitting on a macrocosmic level, that is, the science of hitting has been explained in terms of its gross motor movements (e.g., weight transference to the front leg). In fact, it was not until Kitzman (1964) that the baseball swing was empirically studied on a microcosmic level, one which measured specific muscle groups electromyographically. In his study, Kitzman investigated the functions of the right and left pectoralis major muscles, the right and left triceps brachii muscles, and the right and left latissimus dorsi muscles during the batting swing. This study created an avenue on which scientists could study the batting swing on a new level of complexity, a level on which one could study the relationships betweeen active muscle groups. The relative electrical potentials of muscles, the quality of their signals, and the sequence of their activation are all areas that have been considered (Broer & Houtz, 1967; Kitzman, 1964), yet this latter phenomenon has only been assessed briefly (Broer & Houtz, 1967).

Scientists have utilized kinematography and videotaping to investigate the biomechanical and kinesthetic principles of the batting swing. In recent years, however, the technological advances in video replay have generated many questions concerning the potential uses of its application (Dowrick, 1983). The question that is most pertinent to this thesis asks whether there exists a form of video replay which, through its structure, leads to behavioral change in most subject populations and situations.

Self-modeling is a structured form of video replay that seems to embrace this notion. Dowrick (1983) defined self-modeling as "the behavioral change that results from the observation of oneself on videotapes that show only desired behaviors" (p. 106). The efficacy of such a device, however, is rooted in its ability to provide its viewers with their successes rather than their typical inadequacies. This notion is advocated by Skinner (1981), who related that the value of structuring video replay is in showing adaptive-only responses.

The basis for utilizing self-modeling as a medium for behavioral change comes from its theoretical origins in social learning theory (Bandura, 1977b). The influence of observational learning on personality development is of undeniable importance, and, in fact, most human behavior is learned observationally through modeling. Specifically, from observing others' actions, a person forms an idea of how a correct behavior should be enacted, and on later occasions this "coded" information serves as a guide for action (Bandura, 1977b).

The two major component processes that govern the efficacy of observational learning are the observer's attentional processes and the observer-model similarity (Dowrick, 1983). The ability of a model to capture the observer's attention is an obvious prerequisite to behavior change (Bandura, 1969), and seems to be enhanced by model similarity (Dowrick, 1983). If a high degree of attentional focus by the observer is vital for promoting behavior change, and if model similarity provides impetus for the greatest amount of potential learning in an observer, then the logic for employing self-modeling as a means for behavior change is sound. In fact, self-modeling has been an effective medium by which many physical, vocational, communication, and social skills have been learned (Dowrick, 1983).

In recent years the technological advances in video have made its predecessor, cinematography, obsolete as a tool by which any athletic skill can be captured, observed, analyzed, discussed, and improved. In baseball, reviewing videotapes has been frequently used in aiding hitters to improve their dominant sided swing. It is, however, the intention of this investigator to assist hitters in acquiring the ability to hit effectively from their nondominant side. By having this new ability, hitters who are ordinarily one-dimensional (e.g., bats right) will be able to become switchhitters and, consequently, will offer more to a team as a "complete" offensive player.

The lack of coordination in performing a skill from the nondominant side is obvious, yet it is hypothesized that, through the use of self-modeling videos and batting practice from the nondominant side, hitters will be able to learn to coordinate what is normally an uncoordinated movement. Impetus for this supposition comes from motor learning theory, which contends that motor control processes show changes related to learning and visual feedback effects (Engelhorn, 1979). Furthermore, it seems that after practice or experience with a novel task the motor control system acquires enough information about the task to determine the necessary movement prerequisites and program the movement. Thus, it is logical to conclude that the combination of visual feedback through video replay and experience through batting practice will be sufficient to cause the metamorphosis of an uncoordinated action into one of coordination.

Scope of Problem

This thesis investigated the efficacy of self-modeling as a medium for teaching baseball players to hit effectively from their nondominant side. Nine subjects, 7 of whom were recruited from the 1987 Ithaca College junior varsity baseball team and 2 who were solicited from the 1987 Spring semester Ithaca College baseball skills class, were utilized in this experiment. In order to assess the dependent variable, batting performance, each participant was administered a pretest in which dominant and nondominant batting scores (e.g., solid/flush) were obtained as well as a posttest in which only nondominant batting scores were obtained. Using the same schedule, pre- and posttest electromyography (EMG) recordings of three major upper body muscle groups were collected.

Subjects' posttest batting scores and EMG readings were qualitatively compared to their pretest performances and readings.

Statement of Problem

The effect of self-modeling on nondominant batting performance was assessed. The following questions were contemplated during this investigation:

1. Is self-modeling an effective tool for teaching baseball players to hit from their nondominant side?

2. Is batting practice a mediating variable influencing the ability to learn how to hit effectively from the nondominant side?

3. Can the temporal relationship between the onset of the pectoralis major, triceps brachii, and latissimus dorsi muscles on the nondominant side mirror the dominant side template through a program of self-modeling and batting practice?

Hypotheses

The following null and research hypotheses were investigated in this thesis:

H_O: The observation of self-modeling videos coupled with batting practice will have no effect on nondominant-side batting performance.

H_R: The observation of self-modeling videos coupled with batting practice will enhance nondominant-side batting performance.

Definition of Terms

The following terms have been defined in order to prevent the possibility that they would be misconstrued within the context of this thesis:

Baseball Player: A male with a requisite of either high school or organized summer baseball league experience.

Best Swing: A subjective rating relating to the quality of the action.

Coordination: The relative timing of individual or combined muscle group activity associated with effecient execution of movement.

Dominant Side Template: The ideal characteristics to which the nondominant side is compared.

Electromyography: The study of electrical waves associated with the activity of skeletal muscle.

Kinematography: The science of motion-picture photography dealing with the biomechanical aspects of bodily motion.

Left-handed Batting Template: The model subjects utilized in learning to swing from their nondominant side.

Nondominant Side: That side of the plate with which the baseball player is least experienced, and is associated with uncoordinated movement.

Onset of Muscle Activity: The first major deflection of the integrated EMG signal from the noise floor of the system.

Self-modeling: The behavioral change that results from the observation of oneself on videotapes that show only desired behaviors.

Temporal Sequence: The relationship between the activation of electrical pulses in the three major muscle groups utilized in this study.

Assumptions of Study

The following assumptions were made in this study:

1. All participants were equally motivated to perform to their maximum capacities.

2. The speed of baseballs fired at subjects in the batting cage was representative of the speed of baseballs thrown in game situations.

3. The swings utilized for EMG and video recordings were assumed to be subjects' best swings. Using any other swings would confound results.

4. The clarity and vividness of the self-modeling videos were sufficient for proper video viewing.

5. All EMG recordings were accurate.

6. The selection of baseball batting equipment was sufficient enough so that subjects could choose a bat with which they could comfortably swing.

7. The number of balls hit in pretest, treatment, and posttest sessions was adequate to collect data

points, yet caused minimal exhaustion during testing.

Delimitations of Study

The following delimitations apply to this study:

1. EMG recordings of only the right and left pectoralis major muscles, right and left triceps brachii muscles, and right and left latissimus dorsi muscles were utilized in this study.

2. The video utilized in this study employed a self-as-a-model structure only.

3. Only a 5-day treatment program was applied in this study.

Limitations of Study

The degree to which this study is generalizable is related to the following limitations:

1. Results apply only to the degree that the muscles utilized in this study are indicative of those actually utilized during the baseball swing.

2. Results apply only to a self-as-a-model video format.

3. Results apply only to similar 5-day treatment programs.

4. Results apply only to the extent that the measures of subjects' batting performances and muscle EMG activity were valid.

Chapter 2

REVIEW OF LITERATURE

Self-modeling, a structured form of video replay, has only recently been used as an instructional device (Dowrick, 1983). The logic for its utilization as a technique by which to facilitate batting performance comes from social learning theory (Bandura, 1977b), motor learning theory (Engelhorn, 1979), and neuromuscular feedback theory (Corbin, 1972). The present chapter will focus on the presentation of scholarly material relevant to the self-modeling technique employed in this study. A brief summary will also be included.

Video Replay

The evolution of videotape usage has grown since its inception in the 1960s. During its infancy, video replay was structured so that the pragmatics of its use were rather simplistically assumed to be founded in its self-informational capacities (Dowrick, 1983). That is, the more personal data people could derive from the videotape the better off they would be. As it became apparent that video did not help all people across all situations, the attention of individuals studying video replay effects shifted from emphasizing the viewer to what was being viewed.

According to Dowrick (1983), this new line of thinking led researchers to address the possibility that video replay that is exclusively comprised of successful and adaptive behaviors might lead to behavioral change and therapeutic benefits. From this supposition came self-modeling. Dowrick (1983) defines self-modeling as "the behavioral change that results from the observation of oneself on videotapes that show only desired behaviors" (p. 106). Thus, individuals view videotaped recordings that show their adaptive functioning rather than their typical ineptitudes.

The technique of self-modeling has developed mostly as a result of its own practicality. In fact, as of this point a theoretical basis supporting its use has not been provided by the scientific community. It is clear, however, that the principles of self-modeling can be supported by the theories of observational learning, video feedback, and self-image (Dowrick, 1983).

According to Bandura (1977b), human behavior is learned observationally through modeling. From the active observation of others' behavior, an individual forms an idea of how new behaviors are executed, and on later occasions this coded information serves as a guide for action.

The two major component processes that govern the efficacy of observational learning are the observer's attentional processes and the observer-model similarity (Dowrick, 1983). The ability of a model to capture the observer's attention is an obvious prerequisite to behavior change (Bandura, 1969). Specific attributes of both the model and the observer have been studied (Dowrick, 1983), and the evidence seems to support the notion that a large discrepancy between observer and model leads to failure, whereas a small observer-model difference leads to success. In addition, models presented in televised or videotaped form are so effective in capturing attention that observers learn much of what they see without requiring any special incentives (Bandura, 1977b). In as much as people appear more interested in the sight of their own moving pictures on videotape (Dowrick, 1983), the logic for employing self-modeling as a means of behavior change is rational.

The second major area of research relevant to self-modeling is that of video feedback or self-confrontation (Dowrick, 1983). Positive indications for its use, however, are difficult to find. Apparently, when applied in the treatment of alcohol abuse, this type of confrontation sometimes led clients to drink even more (Schaefer, Sobell, & Sobell, 1972). Yet in an early case study by Creer and Miklich (1970), results were more positive. In their case, self-modeling was used to modify the inappropriate behaviors of a 10-year old boy. After a 2-week intervention program in which the child viewed an appropriate self-model, his behavior improved. Although video feedback results have been equivocal, it seems that all the studies that found negative results used video replay without any adjunctive procedure, whereas reports claiming efficacy often included procedures in which therapists would offer commentaries and advice during video viewing (Dowrick, 1983).

Thus, the notion that the more information people have about themselves the better they will cope became obsolete. In its place came a new paradigm that implied that error identification is not useful in and of itself, but it must also supply information about what to do adaptively (Dowrick, 1983).

The ability of a video to provide its viewers with their successes rather than their typical inadequacies is advocated by Skinner (1981) who related that the value of structured video replay is in showing adaptive-only responses. In fact, the major difference between self-modeling and other forms of video replay is that self-modeling shows no errors (Dowrick, 1983). This adaptive-only technique is based on Dowrick's notion that self-scrutiny alters one's self-esteem in direct proportion to one's perception of success and error rates. It logically follows that a self-modeling technique that maximizes one's performance would invariably increase self-esteem and psychological functioning.

The major support of this thesis comes from Bandura's (1977a) proposal that perception of self-efficacy is essential to acquiring new skills and to coping with failures or other aversive events. Furthermore, Bandura argues that the ability of all individuals to adapt to their environment critically relies on a self-belief system that enables relevant skills to be put into action. It is concluded by Dowrick (1983) that a "feedforward" mechanism, such as self-modeling, provides both the skills information and a positive impact on the self-belief system.

Mental Practice Strategies

In the past, self-modeling videos have been used to teach swimming skills (Dowrick & Dove, 1980) and many other physical skills to individuals across all ability levels (Dowrick, 1983). The ability of self-modeling to be an enriched teaching technique lies, in part, in its ability to function more like a feedforward than a feedback mechanism. That is, self-modeling provides subjects with an image of not so much who they are, but of how they might be (Dowrick, 1983).

This effect is similar to that of the visuo-motor behavior rehearsal (VMBR) technique devised by Suinn (1972). VMBR is a method by which individuals are first relaxed and are then taken through a visualization program where they see themselves performing a skill in their idealized perfect fashion. In essense, this visualization process assists the individual in creating images-of-achievement (Pribram, 1971). Specifically, the VMBR technique is an imaging process that takes advantage of the fact that the newly formed images or images-of-achievement contain all input and outcome information necessary to perform the desired task. Through a constant feedback of environmental stimuli, this image-of-achievement refines itself into a well defined success mechanism.

Evidence to support the effectiveness of the VMBR method, however, has been meager at best. An experiment by Noel (1980) attempted to use the method to increase tennis players' service performance. Results indicated marginal improvement in the percentage of good serves for the higher ability training group only. The inability of the VMBR technique to improve the lower ability group's service percentage was explained by the fact that the service motion described during the imagery tape might have been too advanced for lower ability players. The unrealistic tabulation of the primary dependent measure could also have caused the discrepancy between training groups.

Kolonay (1977) attempted to demonstrate that the VMBR method was more effective than either mental imagery or relaxation alone in facilitating basketball free-throw shooting. Although the VMBR groups' pre- and posttest percentages differed significantly, the ineffectiveness of the statistical analyses and lack of clarity as to how the independent variable was manipulated or the dependent variable assessed only led to further speculation as to the efficacy of VMBR. Weinberg, Seabourne, and Jackson (1981) attempted to replicate Kolonay's (1977) experiment but, instead of using basketball free-throw shooting, they used karate performance as the dependent measure. Although some success was found, the bulk of their results fell short of providing substantive evidence supporting the use of VMBR.

Even though evidence supporting Suinn's (1972) VMBR technique is fraught with questions, other similar methods demonstrating the efficacy of mental practice techniques are well documented (Andre & Means, 1986; Corbin, 1967; Gould, Weinberg, & Jackson, 1980; Meyers & Schleser, 1980). For example, Meyers and Schleser performed a case study using a collegiate basketball player. After teaching the player coping skills to make up for his inability to concentrate, Meyers and Schleser had the subject practice relaxation and imagery exercises every day. After using the relaxation and imagery exercises throughout the remainder of the basketball season, the subject's scoring improved dramatically. Unfortunately, because there were no controls, the authors could not infer that their technique was solely responsible for their subject's improvement.

Corbin (1967), however, found evidence supporting the use of mental practice in the facilitation of skill performance, but only after exposing subjects to real experience. Furthermore, it is imperative that, in order for mental practice to be effective in enhancing skill performance, the learner must be selective in attending to various acts involved in performing the skill (Corbin, 1972). The critical notion that Corbin postulated, however, was that mental practice seemed to be better utilized when based on experience. Support for this thesis comes from Engelhorn (1979) who contended that, after practice or experience with a task, the motor control system has acquired enough information about the task to determine the necessary movement parameters and program the movement. The use of mental practice alone as an enhancing technique would, according to Pribram (1971), only be enough to create an initial image-of-achievement. The lack of experience in performing the skill would deny the individual the ability to change his/her raw skill into a refined action. In fact, evidence provided by Corbin (1967, 1972) supports the notion that the combination of mental practice and physical practice is more effective for learning a task than either technique alone.

Neuromuscular Feedback Theory

One reason imagery is effective in enhancing performance is that electrical impulses are sent out by the nervous system to the musculature and, thus, it prepares the individual to perform the desired movement (Weinberg et al., 1981). This neural feedforward program, originally termed the "ideomotor principle" (Carpenter, 1894), maintains that any idea that dominates the mind finds its expression in the musculature. Neuromuscular feedback theory, as it is now known, further suggests that covert images that generate muscular efference provide kinesthetic feedback necessary to activate future movement schema formulated in the premotor cortex (Hale, 1982).

Jacobson (1931) provided research supporting the original ideomotor principle and further indicated a relationship between imagery modalities and concomitant responses. In his study, bipolar needle electrodes were inserted into the biceps brachii muscle and monopolar needle electrodes were inserted into the recti muscles of the isolateral eye. Amplitude measurements revealed that, when subjects were asked to "visualize bending their right arm," increased action potentials were present in the ocular muscles but were absent in the biceps. Conversely, when asked to "imagine lifting a 10-pound weight," muscular efference appeared in the biceps in more than 90% of the trials, whereas ocular activity was only apparent in a third of the trials. These early results, although not found through sophisticated EMG instrumentation or statistical inference, suggested that the perspective of imagery utilization seems to play a crucial part in determining the location of concomitant efferent responses (Hale, 1982).

Not until Mahoney and Avener's (1977) categorization of imagery into an "internal-external" classification system was the issue of imagery modality related to sport research. Specifically, they defined internal imagery as "requiring an approximation of the real-life phenomenology such that a person actually images being inside his/her body and experiencing those sensations which might be expected in the actual situation" (p. 137). External imagery, on the other hand, was defined as when "a person views himself from the perspective of an observer (much like in home movies)" (p. 137). Their exploratory study, utilizing Olympic gymnastic team candidates, showed that athletes who successfully made the team reported a higher frequency of "internal" rather than "external" images (r = .51).

Although descriptive investigations (Highlen & Bennett, 1979; Rotella, Gansneder, Ojala, & Billing, 1980) have produced equivocal results concerning the importance of imagery perspectives for highly skilled athletes, Hale's (1982) laboratory controlled experiment investigating bicep EMG activity during internal and external imaging of a dumbbell curl provided partial evidence supporting the original ideomotor principle. That is, the internal imagery perspective did produce substantial localized concomitance, whereas external imagery perspective did not. Hale contended that his results implied that "imagery which more totally involves the individual in visual and kinesthetic experiences is more likely to produce localized neuromuscular outflow than merely visualizing and action" (p. 384).

The internal imagery modality seems to take full advantage of Lang's (1979) bio-informational theory of emotional imagery, which assumes that the image in the brain is an organized, finite set of propositions about relationships and environmental descriptors, and that their primary function is to ready the system to respond. Thus, the resulting efferent response is due to the feedforward ability of the motor control system to formulate necessary movement commands and plan the movement while the mind is using an internal imagery perspective (Engelhorn, 1979).

Although there has been extensive research attempting to validate Carpenter's (1894) original ideomotor principle (Hale, 1982; Jacobson, 1931; Schramm, 1967; Shaw, 1940), judgment pertaining to its accuracy cannot be rendered until more sophisticated EMG research reveals the complete picture of neuromuscular activation during covert movements (Hale, 1982).

While EMG has been used with great frequency to investigate muscular concomitants during imaginal experiences, the same cannot be said about its use to study the baseball batting swing. Kitzman (1964), however, used EMG to investigate the functions that the right and left triceps brachii muscles, the right and left latissimus dorsi muscles, and the right and left pectoralis major muscles perform in the baseball batting swing. EMG recordings in his study indicated that, in the batting swing, the aformentioned muscles show considerable contraction early in the swing, and then other muscles and momentum carry the bat through to the end of the swing. After an analysis of the data, Kitzman concluded that, by strengthening the left triceps brachii muscles (long heads), right-handed baseball batters could increase the force that they could transfer to the bat.

In another study, Broer and Houtz (1967) were able to measure EMG patterns of all the major muscles contributing to the batting swing. Although their results were inferred through an "eye-balling" of EMG activity patterns, they do support Kitzman's (1964) contention that the triceps brachii and pectoralis major muscles are very active during the initiation of the batting swing. In fact, the triceps and pectoralis muscles also showed a large burst of activity during the extension and follow-through portion of the swing.

According to Broer and Houtz (1967), it is the forceful extension of the left elbow during the forward swing that causes the burst of activity in the triceps. This strong burst of activity helps to support Kitzman's (1964) notion that the left triceps brachii muscle is responsible for a large part of the force that the bat imparts to the ball.

Summary

The study of the baseball batting swing is certainly not a new endeavor (Lau, 1979). Although the teachings of batting experts have remained anecdotal in nature throughout the 118 years of baseball's existence, the role of science and technology cannot be denied in the attempt to mediate this learning process. Self-modeling is a technique in which an individual's successful and adaptive behaviors are portrayed on videotape (Dowrick,1983). The ability of the self-modeling format to display an individual in a flawless light both enhances self-esteem (Bandura, 1977a) and creates a feedforward mechanism in which the viewer is presented with an image of how s/he might be (Dowrick, 1983). The literature supporting the efficacy of the self-modeling technique itself is relatively sparse (Creer & Miklich, 1970; Dowrick, 1983; Dowrick & Dove, 1980), yet the logic behind the technique is readily apparent under the rubrics of psychology, neuropsychology, and video feedback.

The notion that the results of mental practice are best seen when performed in conjunction with physical practice is invariably supported (Corbin, 1967, 1972; Gould et al., 1980; Meyers & Schleser, 1980). In fact, Engelhorn (1979) supported this observation with his contention that practice with a task enables the motor learning system to ready the body for subsequent action. Thus, the efficacy of self-modeling plus physical practice should be evident in investigations involving motor skill acquisition.

Chapter 3

METHODS AND PROCEDURES

This chapter outlines the selection of subjects, laboratory settings, instruments, procedures, and treatment of data. A summary will be offered as well.

Selection of Subjects

Nine participants, 7 of whom were recruited from the 1987 Ithaca College junior varsity baseball team and 2 who were solicited from the 1987 Spring semester Ithaca College baseball skills class, were utilized in this study. A requisite of either high school or organized summer league baseball experience was maintained in this sample of 9 right-handed hitters.

The 9 subjects were randomly assigned to one of three groups: a batting practice only group, a self-modeling video only group, and a self-modeling video plus batting practice group. Furthermore, 3 subjects, 1 from each group, were randomly selected to participate in electromyography (EMG) testing.

Laboratory Settings

There were three separate experimental environments. The first, a gym, served as the location where all batting trials took place. In the gym was a 70' x 15' x 15' batting cage equipped with a pitching machine (JUGS Curveball Pitcher Model C-1574). This pitching machine was placed 60' 6" away from a plate and set at a reading of "L66," "R56," which enabled baseballs to be fired at a constant 75 mph.

The second milieu was the Smiddy Hall Speech and Language Laboratory. There, EMG data were obtained from 3 subjects as they swung a bat. The space available in the laboratory was sufficient enough to allow subjects to swing naturally without caution.

The third experimental setting was a small room where subjects were first trained to relax and then asked to view their self-modeling videos. This room was equipped with two chairs, which enabled subjects to sit comfortably with or without their feet propped up. Throughout all video sessions a viewing distance of approximately 42 in. was maintained as subjects watched a 27 in. color television set (Samsung T.V. Monitor).

Instruments

Videos for the 6 video-viewing subjects were recorded with a color video camera (Panasonic Newvicon Omnipro) in a dance studio equipped with mirrors. By videotaping subjects' right-handed swings through a mirror, individual left-handed batting templates were created for each subject. In all, six possible templates were videotaped for each subject. After being chosen by each subject, "best swings" were edited and combined one after another in a 3 min 45 s video using a video editor (JVC Professional Editing Recorder, Model BR-8600U). These videos, recorded on video cassettes (Samsung T-120), allowed the participants to view themselves in their prototypical left-handed batting form.

EMG was utilized in this thesis to study the timing of onset of muscle activity of three different major upper body muscle groups, as well as offering evidence of neuromuscular learning (Engelhorn, 1979). Using a computer (IBM-AT), EMG signals were transduced via surface electrodes (SensorMedics Kit No. 650950) and then amplified by a bioamplifier (Coulbourn, Model S75-01) with low and high pass filter settings of 1 and 3000 Hz, respectively. Amplified signals were recorded on four channels of an FM tape recorder (Honeywell, Model 101) for off-line analysis. For analysis purposes the EMG analog signals were digitized on separate channels of an A-D converter (R-C Electronics). These signals were stored in memory of the IBM-AT computer, which served as a storage oscilloscope. Prior to analysis, EMG signals were rectified and filtered. Measurement of onset of muscle activity from each electrode site was based on the output of the A-D converter displayed on the computer monitor.

In accordance with Kitzman (1964), two electrodes were placed 2.54 cm apart on each of the following four muscle motor end points: (a) right triceps brachii (long head), (b) left triceps brachii (long head), (c) pectoralis major, and (d) latissimus dorsi. In addition, an electrode (SensorMedics Collar, P/N 650454) was placed on subjects' earlobes to act as a ground. An onset signal (e.g., tone) was created to notify subjects to swing after its activation. When subjects swung from their dominant side, signals from the right pectoralis major and right latissimus dorsi were recorded, whereas signals from the left pectoralis major and left latissimus dorsi were recorded during nondominant swings. Triceps brachii locations remained constant throughout the study. Furthermore, each subject used the same bat during every EMG testing session.

During the hitting portion of this study, bats (Easton Models B5P BB3430, B5P BB3329, B9P SB3431, and B9P SB3330) were available to be utilized by subjects. In order to avoid confounding results, each subject used the same bat for both the pre- and posttest trials.

Procedures

Once the sample was selected, the investigator met with each participant and presented information pertaining to the nature and purpose of the study, as well as the expected commitment level of the participant.

During the 1st day of the investigation all subjects participated in a warm-up batting practice session. After stretching their muscles, subjects faced 25 pitched baseballs from both their dominant and nondominant sides. As mentioned earlier, baseballs were pitched at them, in the batting cage, at a preset constant velocity of 75 mph. From this point on, subjects were asked not to practice their nondominant swing until the experiment was completed.

The 2nd day of investigation involved a pretest trial. After stretching their muscles, participants were given 20 warm-up swings (10 swings from each side of the plate). Then subjects faced 50 pitched baseballs from both the dominant and nondominant sides. Each swing was rated on a scale from 1 to 5 by the investigator based on the product of each swing at a fired ball. The investigator had vast experience in rating such situations due to his prior work as a baseball coach and hitting instructor. A list of all possible batting scores can be found in Appendix A.

One to 3 days following the pretest batting session, EMG readings of the three aforementioned major muscle groups were procured from the 3 randomly selected subjects in the Speech and Language Laboratory. In a step-by-step procedure: (a) electrodes were placed on the motor end points of each of the three major muscle groups; (b) EMG signals were checked to insure that electrodes were secured on the motor end points; (c) subjects were instructed to take a full swing the instant they heard the onset signal; (d) subjects took five warm-up swings; and (e) subjects took 20 test swings from the dominant side. After subjects finished the 20 test swings from the dominant side, electrodes were taken off and replaced on the motor end points associated with the nondominant musculature. The same step-by-step procedure was used to obtain the nondominant side EMG data.

The 3rd through 7th day of this study were treatment days, and the practice assignments were as described below.

Self-Modeling Video Only Group

The subjects in this group were brought separately into the viewing room where they sat in a comfortable chair and had the opportunity to prop their feet on another chair. Subjects were then instructed to pay close attention to a 20-min progressive relaxation cassette tape. In short, progressive relaxation involves the repeated tensing and relaxing of various muscle groups within the body. The procedure espoused in this tape began with the tensing and relaxing of the arms, moved to the shoulders and neck, then to the chest and stomach, and ended with the tensing and relaxing of the legs. Similar relaxation procedures have often been used to facilitate the imaginal experience (Kolonay, 1977; Noel, 1980; Suinn, 1972). Furthermore, if subjects began to drowse or found their minds wandering, they were instructed to bring themselves back into a calm, yet attentive state of mind. After the cassette tape ended, each subject watched himself batting from the nondominant side on the self-modeling video. During this time the investigator prompted subjects to attend to the important aspects of their swing, as well as enticing them to "feel" the kinesthetic effects of their swing. A complete description of the investigator's instructions can be found in Appendix B. Once video viewing was completed, the investigator made use of a manipulation check to affirm that subjects properly attended to their videos. An outline of this manipulation check can be found in Table 1.

Batting Practice Only Group

Subjects in this assignment were first instructed to loosen up their bodies and then to take 10 warm-up swings from their nondominant side. Subjects then attempted to hit 50 baseballs from their nondominant side.

Self-Modeling Video Plus Batting Practice Group

Subjects in this group were first brought to the viewing room to relax and watch their videos. The video-viewing procedure for this group was identical to that of the video only group. Immediately following the video-viewing session, these subjects went to the batting cage to participate in their hitting trials. The hitting protocol for this group was identical to that of the batting only group.

The 8th and final day of this investigation was the posttest trial. Subjects engaged in 10 warm-up swings from their nondominant side and then had the opportunity to face 50 pitched baseballs from their nondominant side. In addition, nondominant posttest muscle recordings of the 3 EMG subjects were obtained in the Speech and Language Laboratory using the same procedure as in the pretest session.

Treatment of Data

In order to delineate between the proposed efficacy of the self-modeling video plus batting practice program and the two other treatment programs utilized in this investigation, means and standard deviations of individual and group batting performance were calculated. In addition, EMG data, based on the onsets of three major upper body muscle groups, yielded mean temporal sequences by subtracting each muscle's onset time from the right triceps brachii's onset time. Rank orders were then averaged over the 20 trials.

Summary

Subjects were randomly assigned to one of three groups: a batting practice only group, a self-modeling only group, and a self-modeling video plus batting practice group. Milieu for this study included a batting cage, the Smiddy Hall Speech and Language Laboratory, and a small video-viewing room. Means and standard deviations of individual and group batting performances were calculated to distinguish between the efficacies of the three groups. Furthermore, mean temporal sequences were examined by calculating the relative onsets of the three major upper body muscle groups to the three group assignments.

Chapter 4

ANALYSIS OF DATA

This chapter will be presented in the following order: (a) manipulation check, (b) batting performance, (c) electromyography, and (d) summary.

Manipulation Check

In order to assess the attentiveness to their self-modeling videos, subjects in the video only and video plus batting groups were asked to answer a single question after each viewing during their 5-day treatment period. Responses ranged from 1 to 5. They were averaged and descriptive data for each are presented in Table 1.

The manipulation check indicated that the video-viewing subjects did maintain a more than moderate (M = 4.30) amount of attention to their videos. It should be noted that the investigator prompted subjects to attend to the important aspects of their swing, in part to entice them to pay close attention to their videos.

Batting Perfromance

Pre- and posttest performance scores, ranging from 1 to 5, were the mean of 50 trials for each subject. Group means, standard deviations, and pre- to posttest changes can be found in Table 2.

Table 1

Manipulation Check of Attention to Video Viewing

Question: How would you describe your attention to the video?

Response Range:

1	2	3	4	5
Not Attentive		Somewhat Attentive		Extremely Attentive

Condition	Subject	*M*
Video Only (*n* = 3)	1	4.20
	2	4.80
	3	4.20
Batting Plus Video (*n* = 3)	1	4.00
	2	4.60
	3	3.80
Total Subjects (*n* = 6)		4.30

Table 2

Group Means, Standard Deviations, and Pre- to Posttest Changes for Batting Performance

		Pretest		Posttest		Change
Condition	*N*	*M*	*SD*	*M*	*SD*	
Batting Only	3					
Dominant		3.56	1.14			
Nondominant		3.39	1.30	3.81	0.93	+0.42
Video Only	3					
Dominant		3.66	1.00			
Nondominant		3.43	1.21	3.67	1.18	+0.24
Batting Plus Video	3					
Dominant		3.91	1.03			
Nondominant		3.43	1.19	3.67	1.22	+0.24

It is interesting to note that, although all groups (including 8 of 9 subjects) did increase their performance scores from pre- to posttest, it was the batting practice only group (+0.42) that displayed the greatest amount of change, with the video only group (+0.24) and batting plus video group (+0.24) performing equally throughout the study.

Electromyography

The temporal sequence for each trial was determined by subtracting each muscle's onset time from the right triceps brachii's onset time. This procedure allowed the experimentor to identify the order of muscle firing during each swing (e.g., left triceps brachii, right pectoralis major, right triceps brachii, right latissimus dorsi). Rank orders were then averaged over the 20 trials. The temporal sequences for the pre-dominant and post-nondominant swings can be found in Table 3.

Due to scheduling difficulties and the intricacies of EMG testing, 1 subject was randomly selected from each group to participate in EMG testing. The following interpretations are based upon the rank ordering of the EMG data:

1. During the dominant swing, the onset of the left triceps brachii always preceded the onset of the

Table 3

Average Temporal Sequences of the Three Muscle Groups in Dominant and Nondominant Swings

Condition		Pretest (Dominant)	Posttest (Nondominant)
Batting Practice Only	1.	L. Triceps Brachii	R. Triceps Brachii
	2.	R. Pectoralis Major	L. Pectoralis Major
	3.	R. Triceps Brachii	L. Triceps Brachii
	4.	R. Latissimus Dorsi	L. Latissimus Dorsi
Batting Practice Plus Video	1.	L. Triceps Brachii	R. Triceps Brachii
	2.	R. Latissimus Dorsi	L. Triceps Brachii
	3.	R. Triceps Brachii	L. Pectoralis Major
	4.	R. Pectoralis Major	L. Latissimus Dorsi
Video Only	1.	R. Latissimus Dorsi	R. Triceps Brachii
	2.	L. Triceps Brachii	L. Triceps Brachii
	3.	R. Triceps Brachii	L. Pectoralis Major
	4.	R. Pectoralis Major	L. Latissimus Dorsi

Note. Only 1 subject from each condition participated in EMG testing.

right triceps brachii.

2. During the dominant swing, the onset of the left triceps brachii always preceded the onset of the right pectoralis major.

3. The order of activation for the nondominant swing always began with the right triceps brachii and concluded with the left latissimus dorsi. For 2 of the 3 subjects, the temporal sequence was right triceps brachii, left triceps brachii, left pectoralis major, and left latissimus dorsi.

4. The temporal sequence of the dominant side swing of the subject from the batting only group was mirrored exactly by his nondominant swing.

5. The temporal sequences of the dominant side swing for the 2 other subjects were mirrored in three of four instances.

Although these patterns are noted, no single temporal sequence of the three muscle groups was found for either the dominant or nondominant swing.

Summary

The self-modeling technique employed in this study was devised to assist the hitter to improve his skills through a new awareness of visual and kinesthetic perspectives. Results of a qualitative analysis indicated that 8 of the 9 subjects increased their batting scores. The batting practice only group displayed the greatest amount of change. Furthermore, the mean differences for the batting practice plus video and video only groups were identical, however, the results of the batting practice plus video group were more consistent across subjects (see Appendix C). On the basis of the data summarized above, the null hypothesis was rejected in favor of the research hypothesis.

EMG results indicated that subjects' nondominant side temporal seqeuences were, in most situations, patterned after their dominant side counterparts.

Chapter 5

DISCUSSION OF RESULTS

Hypothesis testing requires that certain methodological assumptions be met. Unfortunately, the small group size in this study precluded the possibility of unequivocally determining whether the observation of a self-modeling video coupled with batting practice enhances nondominant side batting performance. The inability to analyze the data through statistical inference, however, does not preclude a qualitative analysis.

On a gross level, all groups, including 8 of the 9 subjects, increased their batting performance scores. Interestingly, the batting practice only group displayed the greatest amount of change. The mean differences for the batting practice plus video and video only groups were identical, however, the results of the batting practice plus video group were more consistent across subjects (see Appendix C). The only subject not improving his batting performance score was a member of the video only group, as might be expected (Corbin, 1972). It cannot be determined, however, how much of the pre- to posttest change in the video only and batting practice plus video groups is due to the self-modeling video. What can be stated is that batting practice alone did enhance the performance in the 3 subjects in that group. This finding is supportive of Corbin's (1972) suggestion that practice is elemental in the facilitation of a physical skill. Although batting practice alone invariably enhanced batting performance from the nondominant side, this study focuses on the efficacy of a self-modeling plus batting practice program for teaching baseball players to hit from the nondominant side.

Certainly the literature supports the use of self-modeling as an instructional device. The theories supporting the self-modeling technique warrant that (a) subjects will properly attend to their own moving pictures (Bandura, 1969), (b) the adaptive-only characteristic of the self-modeling video will maintain and promote feelings of self-worth (Bandura, 1977a), and (c) the adaptive-only format creates a feedforward mechanism whereby the viewer actually sees the preferred movements (Dowrick, 1983). In order to review the aforementioned tenets of self-modeling theory, the quality of the video-viewing process used during this study and the task at hand will be discussed.

Firstly, it is important to note that the videotaping of a dominant baseball swing through a mirror so that an individualized nondominant side template could be made provided the impetus for this investigation. The question remains, however, whether this artificial template provided the ideal nondominant swing for the subjects, or whether it provided an unrealistic model. In other words, was the template the preferred model? Would it have been a better idea to film subjects hitting pitched baseballs, using those swings that were deemed "best" by them in order to create the nondominant model? The difference between the two formats cannot be discerned at the present time. It is the opinion of this investigator, however, that any "real-life" footage would provide a better and more interesting format than any simulated footage. According to Skinner (1981) and Dowrick (1983), the only critical criterion is that the self-modeling video presents adaptive-only responses.

According to this investigator's standards, however, one of the six self-modeling videos portrayed poor batting mechanics. During the viewing of his video, it was evident that this subject was well aware of his flaws. According to Bandura (1977a), Dowrick (1983), and Skinner (1981), this presentation of poor responses should have lowered the subject's self-esteem. This, however, did not appear to be the case. In fact, the subject, after viewing his video, did not show a loss of self-esteem, but openly discussed his mechanical problems and attempted to correct his flaws. This accidental occurrence actually worked in favor for this subject as he increased his batting score from pre- to posttest. It cannot be determined, however, whether the increase was due to the self-modeling video, batting practice, or the combination of the two.

Secondly, other conditions concerning the quality of the video-viewing procedure must be considered. The video-viewing room was extremely small, there was limited air circulation, and outside interference was readily apparent. Even though subjects reported a moderately high attentiveness to their videos (see Table 1), this investigator believes that a more suitable viewing room should have been utilized.

Furthermore, the task itself must be considered in the review of the self-modeling plus batting practice program. Hitting a baseball has long been considered one of the most difficult, if not the most difficult skill in all of sport. It has taken most collegiate players 10 to 15 years to refine their dominant side hitting abilities. Thus, it does not seem all that incredible that the process of teaching baseball players to hit from their nondominant side utilizing the program in question is highly complex and necessitates further research.

It must also be considered whether there could have been difficulty in using the right eye as opposed to the left eye as the predominant hitting eye. The use of a different eye could easily affect (a) how well subjects pick up the spin of the pitched ball, (b) the perceived speed of the ball, and (c) subjects' depth perception within the batting cage. Whether this physiological phenomenon affected subjects' batting performance cannot be answered by the present study.

Finally, one must bear in mind that (a) a few subjects reported painful blisters during batting practice, (b) another participated with a broken finger, and (c) another was just cut from the baseball team that this investigator coached. Any of these realities could have affected the final results; whether they did remains speculative.

The presentation of qualitative results and observations sheds some light on the proposed efficacy of the self-modeling plus batting practice program employed in this study. It is the opinion of this investigator that, although statistical inference could not be made, the overall swing coordination of each subject did improve from pre- to posttest. This coordination, defined as the relative timing of individual or combined muscle group activity associated with efficient execution of movement, was empirically supported through EMG measurement.

Earlier investigations (Broer & Houtz, 1967; Kitzman, 1964) contributed to the basic understanding that the triceps brachii, latissimus dorsi, and pectoralis major muscles play critical roles in the initiation of the baseball batting swing. Furthermore, Broer and Houtz (1967) discovered that the triceps and pectoralis muscles also showed large bursts of activity during the extension and follow-through portions of the swing. The aforementioned information led this investigator to query whether the temporal relationship between the onsets of the pectoralis major, triceps brachii, and latissimus dorsi muscles in the nondominant swing could approach or mirror the dominant side template through a program of self-modeling and batting practice. Support for this thesis came from Engelhorn (1979) who contended that, after practice with a task, the motor control system has acquired enough information about the task to determine the necessary movement patterns and program the movement.

Results showed that, although no single temporal sequence of the three muscles groups was found, the mirroring phenomenon was present in all 3 subjects. As can be seen in Table 3, the dominant temporal sequence of the subject in the batting practice only group was mirrored exactly by his nondominant swing pattern. Furthermore, the dominant temporal sequences for the 2 other subjects were mirrored in three of the four muscle groups.

It is speculated that the differences in specific sequences for the 3 subjects are due to the highly individualistic nature of the baseball swing. In fact, it must be made clear that it is not the comparison of sequences between subjects that is important, but the comparison of sequences between each subject's dominant and nondominant swings. When this comparison is made, it is apparent that the motor control system has learned to pattern the nondominant swing after the dominant swing.

Summary

In summary, the analysis indicated that the self-modeling video plus batting practice program employed in this study was effective in facilitating both subjects' nondominant side batting performance and subjects' nondominant side swing coordination. It is speculated that the refinement of the aforementioned program would further improve the chances of baseball players learning to hit effectively from their nondominant sides.

Chapter 6

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This chapter provides a synopsis of the entire investigation and it is presented in the following order: (a) summary, (b) conclusions, and (c) recommendations.

Summary

Self-modeling is a technique in which an individual's successful and adaptive behaviors are portrayed on videotape (Dowrick, 1983). The ability to see oneself perform flawlessly both enhances self-esteem (Bandura, 1977a) and creates a feedforward mechanism in which the viewer is presented with an image of how s/he might be (Dowrick, 1983). The literature supporting the efficacy of the self-modeling technique itself is relatively sparse (Creer & Miklich, 1970; Dowrick, 1983; Dowrick & Dove, 1980), yet the logic behind the technique is readily apparent under the rubrics of psychology, neuropsychology, and video feedback.

In addition, the notion that the results of mental practice are best seen when performed in conjunction with physical practice is steadfastly supported (Corbin, 1967, 1972; Gould et al., 1980; Meyers & Schleser, 1980). Thus, the efficacy of the self-modeling plus batting practice program employed in this study is supported by the literature.

This program was designed to combine the visual and kinesthetic effects of the self-modeling video with the motor learning effects of batting practice in order to teach baseball players to hit from their nondominant sides. In the attempt to analyze the research data, it was found that the small group size precluded the use of parametric statistical hypothesis testing. Means and standard deviations of batting performance, however, were reported.

Through this analysis it was found that 8 of the 9 subjects participating did increase their batting performance scores. The mean differences for the batting practice plus video and video only groups were identical, however, the results of the batting practice plus video group were more consistent across subjects (see Appendix C). Furthermore, the only subject not improving his batting performance score was a member of the video only group. This finding is supportive of Corbin's (1972) contention that practice is critical in the facilitation of a physical skill.

As an additional assessment of the effects of the program employed in this study, electromyography recordings of the onset of three major upper body muscle groups were procured. A qualitative analysis of the EMG data indicated that, after experience in their respective treatment programs, subjects' nondominant side temporal sequences were patterned after their dominant side counterparts.

Conclusions

1. Results of the study indicated that the batting practice only group displayed the greatest amount of improvement. Furthermore, the mean differences for the batting practice plus video and video only groups were identical, however, the results of the batting practice plus video group were more consistent across subjects (see Appendix C). The aforementioned data coupled with the EMG data indicated that the combination of observing a self-modeling video and participating in batting practice is efficacious in the facilitation of baseball players' nondominant side batting performance. In order to provide stronger support for the thesis of this study, certain methodological assumptions will have to be met in the future.

2. In as much as subjects' nondominant side temporal sequences were patterned after their dominant side counterparts, it is concluded that the combination of video replay and batting practice is sufficient to change a normally uncoordinated action into one of coordination.

Recommendations

The following recommendations are made for individuals interested in adding to the research on this topic:

1. It would be possible, and in one's best interest, to replicate this study utilizing a minimum of 10 subjects per group. This aspect of the present study did not meet group size standards due to the investigator's original belief that all subjects would participate in EMG. In fact, when the impossibility of having 9 subjects participate in EMG became apparent, the number was reduced to 3.

2. Additional research in this area should be conducted in an attempt to refine dominant side hitting. The pragmatics of teaching dominant side hitting is evident by the fact that most baseball players either bat right-handed or left-handed but not both.

3. The simulated self-modeling video format employed in this study should be compared to a video format which depicts as real a situation as possible. Live dominant side hitting should be video taped and edited in such a way as to show adaptive-only behaviors.

Appendix A

BATTING SCORING SCALE

1. Miss.
2. Ticked--just getting a "piece" of the ball (a near miss).
3. Nubbed--foul tip.
4. Weak contact.
5. Solid/Flush.

Appendix B

SELF-MODELING VIDEO PROMPTS

1. "Notice how you keep your head still."
2. "Notice how your shoulder remains tucked in."
3. "Notice where your hands are as your front foot touches the ground."
4. "Feel your hips open up as you take a nice short stride."
5. "Feel your arms swinging through the hitting plane."
6. "Feel yor wrists turning over as you fully extend your arms."
7. "Feel the easy follow-through."
8. "Watch how you keep your balance throughout the entire swing."

Appendix C

MEANS AND STANDARD DEVIATIONS OF SUBJECTS' NONDOMINANT HITTING

	Pretest		Day 1		Day 2		Day 3		Day 4		Day 5		Posttest		
Subject	<u>M</u>	<u>SD</u>	<u>M</u>	<u>SD</u>	<u>M</u>	<u>SD</u>	<u>M</u>	<u>SD</u>	<u>M</u>	<u>SD</u>	<u>M</u>	<u>SD</u>	<u>M</u>	<u>SD</u>	<u>Δ</u>[a]
1-1	3.40	1.09	3.40	1.14	3.30	1.22	3.64	1.31	3.66	1.32	3.74	1.03	3.82	1.10	0.42
1-2	3.24	1.32	2.62	1.65	3.30	1.43	3.24	1.38	3.64	1.32	3.56	1.34	3.40	1.44	0.16
1-3	3.64	1.14	3.68	1.28	3.42	1.23	3.52	1.33	3.84	1.22	3.40	1.30	3.80	1.07	0.16
2-1	3.30	1.33	3.20	1.21	3.38	1.40	3.32	1.11	3.36	1.05	3.80	0.90	3.74	1.05	0.44
2-2	3.60	0.99	3.92	1.10	3.86	0.99	3.76	0.89	3.66	0.82	3.78	0.97	3.92	0.67	0.32
2-3	3.26	1.52	3.50	1.30	3.10	1.34	3.66	1.30	3.64	1.16	3.60	1.14	3.76	1.04	0.50
3-1	3.08	1.31											3.80	0.95	0.72
3-2	3.44	1.18											3.40	1.40	-0.04
3-3	3.76	1.04											3.82	1.12	0.06

<u>Note</u>. The first number under subject heading refers to the group to which he belonged: 1 = batting practice plus video; 2 = batting practice only; 3 = video only.

[a] Δ refers to the difference between post- and pretest means.

Appendix D

INFORMED CONSENT FORM

1. a) Purpose of the Study. To teach baseball players how to hit effectively from their nondominant side using self-modeling videos.

b) Benefits. To introduce a new method for teaching baseball players how to hit both right-handed and left-handed. Thus, hitters who are ordinarily one-dimensional (e.g., bats right) will be able to become switchhitters, and, consequently, will offer more to a team as a "complete " offensive player.

2. Methods. Subjects will be administered a pretest where dominant and nondominant batting scores (e.g., solid/flush) and electromyography (EMG) recordings will be obtained, and a posttest where only nondominant batting scores and EMG recordings will be obtained. EMG is a procedure whereby electrodes are placed strategically on the surface of the skin in order to record electrical discharges of muscles. A creamy substance is smeared on the electrodes to better conduct the muscle firings. As you swing a bat in the laboratory, EMG will be recorded through surface electrodes only. There are no risks in this procedure. Between the testing sessions, subjects will be involved in a 5-day treatment session. One group of subjects

will only practice batting, another will only view self-modeling videos, and a third group will practice batting and view self-modeling videos. During the third video-viewing session, EMG recordings of three upper body muscle groups will be obtained. The results of these recordings will demonstrate that your muscles are involved in neuromuscular learning. Furthermore, during viewing, the investigator will prompt subjects to tend to the important aspects of their swing. In addition, the investigator will make use of a manipulation check after all viewing sessions to affirm that subjects are properly attending to their videos. The procedure will take approximately 6 weeks.

3. Will this hurt? No physical or psychological risks are evident. Some frustration might arise in learning how to hit from the nondominant side, but the investigator will offer assistance to help negate frustration.

4. Need more information? Additional information can be obtained from either Michael A. Simon (277-5104) 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 any time.

6. <u>Will the data be maintained in confidence</u>? All data and videos will be confidential. Once data are collected, names of subjects will be discarded and replaced by subject number (e.g., Subject 9). Data will be analyzed by group, not by individual subject.

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 E

RECRUITMENT DIALOGUE

"Good afternoon, I'm Mike Simon, and I'm a Graduate Assistant baseball coach for the junior varsity here at Ithaca College. At the present time, in addition to my coaching duties, I am conducting research for the thesis requirement I have to complete in order to receive my master's degree in physical education.

In general, my research concerns teaching right-handed hitters how to hit effectively from their nondominant side, or simply from the left side of the plate, by using self-modeling videos. I'm looking for 9 committed volunteers who normally hit from the right side, and who have at least high school experience or play baseball during the summer in an organized baseball league.

In consenting to this study, you will need to commit yourself to 4 weeks of participation. While a subject in this study, you will hit from 230-500 baseballs spread over 8 days of testing, depending to which of the three groups you will be randomly assigned. If you are assigned to a self-modeling utilization group, you will view individualized videos in order to improve your switchhitting ability. In addition, electromyography readings of three upper body major muscle groups will be obtained from each subject at different times during your participation.

If you are interested in learning how to switchhit and/or want to introduce yourself to the new and exciting world of self-modeling, a method for teaching yourself virtually any skill, then contact either myself, Mike Simon at 277-5104 or Dr. Craig Fisher at 274-3112. Thank you for your time, and remember that watching baseball is great, but grabbing a bat and playing is something else!"

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