

THE UTILIZATION OF MENTAL PRACTICE IN  
THE LEARNING OF SELECTED  
TENNIS SKILLS

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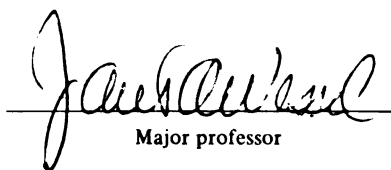


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## ABSTRACT

### THE UTILIZATION OF MENTAL PRACTICE IN THE LEARNING OF SELECTED TENNIS SKILLS

By

Ada Letitia Loveless

The purpose of this study was to investigate the effects of mental practice as a method to facilitate physical skill learning. The skills were the forehand and service for tennis. All treatments were in addition to the learning experiences in the classes and instructional procedures were the same for all classes. The mental practice was provided through audio tapes made by the author. Skill was measured in two ways: on performance and on form.

The purpose of the study was twofold:

- (1) to assess the effect of step-by-step guided mental practice for beginners on the learning of two complex tennis skills;
- (2) to determine the relative effects of two types of mental practice information on learning skills.



The subjects were fifty-four undergraduate male and female students enrolled in three beginning tennis classes at Kalamazoo College, Kalamazoo, Michigan, during the ten-week winter term, 1977. The students were pre-tested on form and performance. Verbal SAT scores were obtained, the median determined, and students classified as high (above the median) verbal ability or low (below the median) verbal ability. Students were then randomly assigned to one of four treatment groups by high/low verbal ability.

MPP--Mental Practice Positive

MPEIEE--Mental Practice, Error Information,  
Experience, and Elimination

APP--Added Physical Practice

PMP--Placebo Mental Practice

The MPP tape content reiterated and emphasized the material presented through class instruction. The MPEIEE tape added error information, experience, and instruction for correction of errors. Mental practice was controlled by placing the audio tapes on closed reserve in the college library. Lists of students by tape group assignment were given to the library. This facilitated control of proper tape listening.

Video tapes were made during the pre- and post-performance tests. The tapes were randomized to keep



the raters blind to treatment conditions and time of observation. Forehand and service data were analyzed separately.

The pretest scores functioned as covariables. The data were analyzed on the Finn Program of multivariate and univariate analysis of covariance and regression at Michigan State University.

The results of the study were as follows:

1. There was no significant difference in treatments on either performance or form for the forehand and the service.
2. There was no significant interaction between verbal ability and treatment on either performance or form for the forehand and the service.
3. All treatments resulted in significant improvement on form and performance of the forehand stroke.
4. All treatments resulted in significant improvement in service form but not service performance.
5. Study results support earlier research which found that a combination of physical and mental practice was as effective for learning physical skills as physical practice alone.



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By

Ada Letitia Loveless

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## CHAPTER I

### INTRODUCTION TO THE STUDY

Early learning theories contributed little to the concept of approaching motor skill learning with concentrated mental activity or practice. Later learning theories, recognizing the learner's intellect and awareness which initiate learning through the cognitive processes, are an important approach in motor skill learning. This study utilized the cognitive processes through mental practice in motor skill learning.

#### Rationale for the Research

The significant involvement of cognitive processes in the initial stages of learning motor skills is now generally accepted by motor learning theorists (Fitts, 1962; Adams, 1971; Cratty, 1972). It has been proposed by Fitts (1962) that three stages can be identified in learning motor skills: cognitive, fixative, and autonomic. Gagné (1952) suggests four phases of a learning sequence: apprehending, acquisition, storage (short- and long-term), and retrieval. Once the task is understood,

in the first stage or phase, repetition is required to fix or stabilize the skill. At the end of this stage, the skill becomes automatic and can be retrieved from storage quickly. It can then be executed without conscious thought. In the autonomic stage of a skill, cognitive processes of the learner are then free to receive new information and attend to other stimuli in the environmental context of the skill application. The cognitive process is present in complex human learning and performance, regardless of the stage of learning or performance. It never disappears or becomes unnecessary; rather, it shifts in focus as learning progresses. It is this cognitive learning process to which this research is addressed.

Few studies have been completed in the past forty years to determine the effect of mental practice upon the learning and retention of motor skills. Although most of this research has shown statistically significant benefits from mental practice, little systematic effort at practical application has been evidenced. If cognitive ability is an ongoing process along the learning-performing continuum, it is reasonable to assume that learners can benefit from access to, and internalization of, additional information related to particular skills. Further investigation is needed to determine the role of mental practice in providing stimulation to the conceptualization of skills. Sequential difficulty of mental practice content





is needed to accommodate different levels of skill development. Different media for providing mental practice information need to be explored. The significance, if any, of better acquisition with mental practice should be further investigated.

#### Purpose and Scope of the Research

The purpose of this study was twofold:

- (1) to assess the effect of step-by-step guided mental practice for beginners on the learning of two complex tennis skills;
- (2) to determine the relative effects of two types of mental practice information on learning motor skills.

This study examined the effects of two distinct types of planned mental practice content in combination with physical practice. The procedure for mental practice was limited to the listening of audio tapes.

#### Initial Limitations of the Research

The subjects in this study were enrolled in beginning tennis classes which were offered as an elective activity through which students could partially complete the graduation requirement in physical education at Kalamazoo College, Kalamazoo, Michigan. Opportunity for uncontrolled physical practice was essentially nonexistent during the winter months in which this study

was conducted. The indoor tennis courts received maximum use by other groups for a variety of sports activities and were therefore inaccessible to the subjects in this study.

Control and monitoring of planned mental practice was achieved through placing the audio tapes on closed reserve in the college library. Lists of students in each tape listening group were supplied to the library staff to ensure that each student received the correct type tape. There was no way to control unplanned mental practice either for those in the mental practice or the physical practice groups.

#### Basic Assumptions and Null Hypotheses

The first assumption was that the MPEIEE treatment (mental practice with error identification, error experience, and error elimination) would result in more improvement in both stroke form and stroke performance than the MPP treatment (mental practice positive) which was designed to repeat only the information concerning the stroke patterns practiced in class. The rationale for this assumption was that the identification of common errors and mental practice on error elimination would prevent learning typical errors and the consequent need to unlearn. It was also believed that this approach to error identification and elimination would strengthen subject interest in learning these skills.

The second assumption was that the MPEIEE group would achieve both stroke performance and stroke form commensurate with the group receiving additional physical practice (APP). The rationale for this assumption was based on the premise that the group which received additional physical practice would show the most improvement.

The third assumption was that the MPP group would achieve better stroke performance and stroke form than the control group with placebo mental practice (PMP). The rationale for this assumption was that valid content in the tapes of the MPP group would have greater impact on the learning of the two skills than placebo content for the PMP group.

These three assumptions formed the basis for the first null hypothesis:

Null Hypothesis 1:

There will be no significant difference between treatment groups on improvement in performance and form on the forehand and service.

The fourth assumption was that the subjects with high verbal ability would benefit more from mental practice than subjects with low verbal ability. The rationale for this assumption was that the subjects with high verbal skills would learn more as a consequence of mental practice. This fourth assumption formed the basis for the second null hypothesis:

**Null Hypothesis 2:**

There will be no significant difference between treatment groups by high/low verbal ability interaction.

These four assumptions and the two null hypotheses were subsequently tested in this research study. The review of the literature indicated that there has been a persistent interest in the study of mental practice and its role in motor skill learning. However, research on this subject has been sparse and has had limited results. This study was undertaken to ascertain the role of mental practice and its effect on the learning of tennis skills, primarily to determine whether mental practice could have a more productive role in expediting the learning of various physical skills.

## CHAPTER II

### REVIEW OF RELATED LITERATURE

#### Historical Update: Development of Interest in Mental Practice of Physical Skills

Interest and research into the possible manifestations of mentally rehearsing or conceptualizing physical skills apparently began as a result of Jacobson's work in electrophysiology (Jacobson, 1932). His study revealed that when subjects were lying relaxed, with eyelids closed, imagining or recollecting an activity, there was slight and fleeting contraction only of the muscle fibers which would perform the action. He also discovered that the body cannot relax unless the mind is free of activity.

Possibly American education was more receptive at this time to investigations dealing with conceptualizing physical skills. For example, by the 1930s, Koffka's book, The Growth of the Mind, had greatly influenced American learning theory with its criticism of both Thorndike's trial-and-error learning and behaviorism (Hilgard, 1966). The concept of organization applying to learning, as well as to perception, opened up the possibility of insightful learning.

Despite Jacobson's discovery and changes in the comprehensiveness of learning theories, research concerning mental involvement in learning and performing physical skills remained scarce. During the first twenty-eight years after Jacobson's findings, only eight additional studies had been reported. Since 1960, another twenty-seven additional studies have been reported, more than half of which utilized gross motor tasks representative of sports skills.

Cratty (1973b) briefly mentioned some ongoing research in Eastern Europe to improve tactical ability by flashing "game situation" pictures to athletes who then responded to various questions. Other studies employing mental practice by skilled athletes just prior to performing were referred to by Cratty (1973b). He indicated, however, that much of the statistical treatment was unsophisticated and interpretation of data remained difficult.

Although the volume of research is not large and the methodology is sometimes inadequate, there appears to be a continuing interest in investigating the potential role of mental practice in motor skill learning and performance.

### Review of Research

This review of research is organized according to those factors which the present study is designed to

investigate: types of mental practice--structured rather than unstructured, with different content orientations; and type of criterion skill--complex-gross rather than complex-fine. The subsequent discussions define and describe each factor and its related research in detail.

### Types of Mental Practice-- Unstructured

This section includes those studies in which mental practice was left to the imagination of the subject. The research conducted utilizing unstructured mental practice involved few, if any, specific instructions to the subjects. In a variety of research efforts in the area of unstructured mental practice, subjects were requested to imagine or visualize a task or physical activity. These subjects were subsequently tested to determine the effect on learning resulting from unstructured mental practice. The following studies are related to specific research conducted and the results achieved in this area.

Ammons (1951) used ocular, blind-fold manual, and imaginary pre-practice on a rotary pursuit performance test and found that neither imaginary nor physical practice had an appreciable effect. He did, however, suggest that imaginary practice may have had an appreciable effect not detected by his statistics. His imaginary group's recovery from temporary work decrement was less



by one-third and from warmup decrement by almost one-half. He also suggested that the component pre-practice probably needed to be longer than in his study to have any effect. There were no instructions except to imagine the movement.

In G. Gilmore's study (1972) to determine which of five different practice conditions were most effective (controlled mental, uncontrolled mental, physical, controlled mental and physical combined, and placebo control), three groups--the uncontrolled mental practice group, the physical practice group, and a combination of physical practice and controlled mental practice--were all significantly better than the controlled mental practice group and the placebo control. The task was a modified kip. Gilmore also investigated the interaction of sex and experience and found that males were more effective under all practice conditions and that experience was not a factor. It is possible that there was a motivation problem as the females varied little under all practice conditions.

Jones (1965) investigated two conditions of mental practice, directed and undirected. This two-week study led him to conclude that the undirected group scored better, possibly because the directed practice inhibited completion of the cognitive pattern. Neither group had physical practice. The task was to perform a hock-swing upstart to criterion, pass or fail, in two trials. The

treatment of the two groups was not very discriminatory in that the undirected group received the same practice on four of the seven practice days as did the directed practice group.

Rapp (1973) conducted a rope-skipping task with children in which the mental practice was undirected. The mental practice group was instructed to imagine rope skipping with their eyes closed. The mental practice group and the physical practice group increased in proficiency significantly over the control group after nine days of practice, twenty minutes daily.

Rawlings, Rawlings, and Chen (1972) conducted a rotary pursuit tracking study in which the mental practice group was instructed only by being asked to visualize the task. The other group had an interference task. Both groups had physical practice alternated with their experimental treatment. The daily mean time on target was higher for the mental plus physical practice group than for the physical practice plus nonrelated reading task group.

Another example of unstructured mental practice occurred in a study by Shick (1970). In three different studies, the mental practice was done on the students' own time and consisted of mentally rehearsing by imagining the task, with no instructional media. Shick found no conclusive results. The tasks were the wall volley

and serve in volleyball. In two studies, Shick combined physical practice with mental practice; in the third study, she treated mental practice and no practice. In the case of the first two studies, one group practiced only one minute each time (to avoid the Hawthorne effect) and the second group, three minutes. There was no indication how frequently the mental practice periods occurred.

Twining (1949) used unstructured mental practice in a ring-tossing task. Of the three groups--no practice, physical practice, and mental practice--the physical practice and mental practice groups improved significantly while the physical practice group was best.

#### Types of Mental Practice-- Structured

Research studies involving structured mental practice generally required the subjects to mentally rehearse skills according to a set of specific directions. More research using this approach to mental practice has been conducted than research utilizing the unstructured type of mental practice. The results of structured mental practice have also been more pronounced as the following summary reports.

An early study by Gagné and Foster (1949), which was not strictly a mental practice study, deserves to be mentioned. In this study, subjects were given paper and pencil pre-practice on a simple hand-arm response to

controls. The number of practices ranged from zero to forty-eight in increments of eight. No significant differences on response time between the groups were found on the first ten trials on the motor task. By the thirtieth trial, the learning increased in direct proportion to the number of preliminary paper trials. The increase was greatest through sixteen paper trials and less after that. There was also a reduction in errors. Gagné and Foster theorized that the pictured representation was effective due to a pre-differentiating of stimuli by the preliminary task. This study is significant and similar in theory to a recent study by Thiffault (1974).

Thiffault (1974) studied tachistoscopic training and its effect upon visual perceptual speed of ice hockey players. He found that the experimental groups improved significantly more than the control groups in performance during the training period according to pretests and posttests of visual discrimination and visual perception. This well-controlled study has significance for visual mental practice related to game situations.

Smith and Harrison (1962) conducted a study on visual, mental, motor, and guided (kinesthetic) practice of a stylus-type three-hole punchboard task. The final test was for speed and accuracy. Visual and mental practice improved both speed and accuracy, while

accuracy was greater with motor or guided practice. In terms of total performance on speed and accuracy, the order from best to least was motor, mental, visual, reversed-visual, control, and guided.

Whitehead's study (1974) on types of feedback on performance and the subject's perception of performance during early learning included visual feedback by means of video tape. Other feedback groups were video/conventional, conventional, and mental. The task was a diving forward roll, jump full turn. No significant difference was found between treatment groups on perception of performance or performance itself.

Several studies have used written materials for mental practice. In some studies, the material is read by the subjects, in some it is read by the experimenter to the subjects, and in some cases both techniques were used. Corbin (1967a), Egstrom (1964), and Clark (1960) all used written materials to be read for mental practice. In Corbin's study (1967a), a wand-juggling task was used. He used a mental practice group, a physical practice group, and a control group. The mental practice group practiced by reading an instruction sheet every practice day. He wanted to test the idea that mental practice facilitates learning when the subjects have had experience with the skill. Each of the groups had five days of physical practice after an initial test to determine

skill level. After thirteen days of practice as prescribed, a posttest was given. Corbin found the physical practice group superior to the mental practice group and the mental practice group better than the control group.

Egstrom (1964) utilized a novel task, but he also used written directions for mental practice. His study was directed primarily at varying sequences of manual and conceptualizing practice. Subjects held a paddle in their nonpreferred hand and had to strike a rubber ball which was ejected from a tube every twenty seconds. In striking the ball, they redirected it 90° to a target twenty feet away. Egstrom conducted a pilot study to design a task which could be learned in four weeks. He concluded that manual practice was more effective but that conceptual practice was also effective. A significant finding was that the group which alternated manual and conceptual practice daily gained as much as the group with only manual practice, having practiced manually with 60 percent less frequency.

The third study which specified written instructions for mental practice was by Clark (1960). This study used high school boys, and the task was the one-hand foul shot. The primary question investigated was the substitution of mental for physical practice. The study covered a period of fourteen consecutive days. Prior to this two-week period, each group received a careful introduction

to the experiment consisting of instructions on the technique of foul shooting, mimetic drill, practice, and pretest. The mental practice group read the written instructions each practice day. There were significant gain scores for both physical and mental practice groups with the physical practice group higher.

Smyth's study (1975) with pursuit rotor and mirror tracing indicated closely controlled mental practice but did not specify the type. In the mirror-drawing task (six-pointed, double-lined star) and the pursuit rotor, she found mental practice ineffective for initial skill learning. She did not follow any active trial for the mental practice group on the mirror drawing prior to the final test. On the pursuit rotor, all groups who had active practice of any duration or sequence were equal to or better than those with none.

Oxendine (1969) conducted three separate experiments in which oral instruction was used for mental practice. All subjects were junior high school boys. All studies were conducted in essentially the same way, with different tasks: pursuit rotor, soccer kick, and jump shot. In each study there were four groups with the following combinations of practice: 100 percent physical, 75 percent physical--25 percent mental, 50 percent physical--50 percent mental, and 25 percent physical--75 percent mental.

Oxendine found no significant difference between groups on various mental practice and physical practice combinations for the soccer kick and jump shot but did for the pursuit rotor. On the pursuit rotor, the first and second groups were significantly higher than group four, and group three was almost at a level to be significant over four. This study utilized a seven-day training program. He concluded that up to 50 percent of practice time on mental practice can be as effective as 100 percent physical practice, provided the task is within the motor capacity of the learner. He also concluded that the proportion of time spent on mental practice seems to be dependent upon the complexity of the task, the familiarity of the task, and the physical ability of the learner to perform the activity.

Another study which controlled the mental practice group closely was a study by Wilson (1960) to investigate the effects of three different combinations of mental practice and physical practice on learning the tennis forehand and backhand. An analysis of variance revealed no significant difference in the mean gains for the three groups. Each group consisted of college women who had taken at least one course in tennis. Each group also included subjects classified by skill rating as low intermediate, high intermediate, and advanced. After taking a pretest, all groups repeated the test every



other day for twelve days. The mental practice and physical practice groups each practiced as prescribed on alternate days while the control group did nothing on alternate days. The physical practice group practiced twenty-eight strokes against the wall, and the mental practice group repeated the test in the classroom. As sub-problems, Wilson compared performance errors for the three groups and also sought to determine the relationship, if any, between selected aptitude tests and change in proficiency. The aptitudes measured were space relations, mechanical reasoning, and abstract reasoning. None of these factors were significant to increased proficiency according to rank difference correlations. On the performance curves, the highest skill-rated subjects maintained their superiority throughout the test, and there was no marked change in the difference between the highly skilled and lesser skilled. This study was conducted in twelve days.

Start (1964b) conducted a study in which the mental practice was structured as follows: practice sheets contained a detailed analysis of the skill; subjects read and paused where indicated to imagine; subjects imagined as instructor read aloud; subjects read as instructor read aloud; and subjects imagined without cuing. The single leg upstart was the task. The subjects were males, eighteen to twenty-one, naive to the

task. Performance was rated by three judges ( $r=.9$ ), mean ratings T-scaled. Conclusion: The kinesthesia formula scores and the skill scores after mental practice were not significantly related.

In their study of controlled or directed mental practice, R. Gilmore and Stolurow (1951) found interference of skill learning with the directed mental practice group as compared to the motor trained and rest groups. This is an atypical finding and persisted through three replications. The task was a ball and socket task.

The results of these twelve research studies were mixed. For example, Thiffault's study (1974) had positive results for visual mental practice; Whitehead (1974) found no difference; Corbin (1967a) found that both the physical and mental practice groups performed better than the control group; Egstrom (1964) concluded that manual practice was more effective; Oxendine's three studies (1968, 1969, 1972) had differing results; and Wilson's research (1960) revealed no difference in the mean gains for the three groups. The variation of reported results suggests that additional research with structured mental practice on the effect of learning skills could be productive--at least in ascertaining whether this is a field of research which could have significant impact on the learning of physical skills.

### Types of Tasks Used in Mental Practice Research

Another set of factors considered in the literature review involved the type of criterion skill used in the research, i.e., whether fine or gross skill was utilized. Most of the research reported in this section involved complex skill learning which occurred in a variety of settings.

#### Complex-Fine Motor Skills

Ulrich (1967) investigated several commercial type motor skills in separate studies including finger dexterity, typing, and riveting. These studies included males and females except for the riveting study in which all subjects were male. The typing test was for fourteen- to sixteen-year-old males and females who had one year of typing. Some conclusions were: motor skills can be learned by active, observative, or mental training; mental training is superior to observative training; mental training was nearly as successful as active training in a number of cases; and alternating active and mental training was more successful in most groups than only active training.

In an early study involving mental practice, Perry (1939) used five fine motor tasks: peg board, symbol digit substitution, card sorting, mirror tracing, and three-hole tapping. The subjects were school

children, and the major question was the relative efficiency of imaginary and actual practice in performing these five tasks. The results showed that card sorting, peg board, and the symbol digit task were better adapted to imaginary practice than mirror tracing and three-hole tapping. Perry concluded that this was because these tasks contained facts which could be learned by observation. His reasoning was that these three tasks required designated associations and some motor coordination while mirror tracing and three-hole tapping required a high degree of motor coordination. This study revealed little in relation to the superiority of one type of practice over the other, but it did raise questions about the variability of tasks or conditions which might be further investigated.

The pursuit rotor has been used in many studies involving mental practice. Some of these have already been discussed. Singer and Witkin (1970) used pursuit rotor to study point of introduction of mental practice within the physical practice schedule. No significant differences were found between the groups when mental practice was variously introduced at the beginning, middle, and end, for two days in an eight-day period. All physical practice groups and combination groups proved to be equally effective. This study used college women as subjects.

Surburg (1976) used pursuit rotor in a recent study with elderly people ranging in age from sixty-five to one hundred. He found the combination of mental and physical practice superior to the control group. There was, however, no significant difference between the physical practice groups and the combination groups. Neither did he find any superiority of practice condition in the retention phase.

#### Complex-Gross Motor Skills

Gymnastics skills have been used as tasks in six of the studies reviewed. Three of these were investigating the effectiveness of mental practice per se. Jones (1965) used unstructured mental practice and found it effective with the hock-swing upstart. Gilmore (1972) found uncontrolled mental practice, physical practice, and a combination of controlled mental practice with physical practice more effective than controlled mental practice and placebo control using the modified kip as the task. Whitehead (1974) used mental practice as one of four forms of feedback and found no significant difference between the four forms on the subject's perception of performance and their rating on performance. The skill was a diving forward roll jump turn.

The study on the tennis forehand and backhand by Wilson (1960), in which mental practice was controlled, showed no significant difference in type of practice on

improved performance. In other words, the mental practice was as effective as the physical, and the group with less physical practice was as effective in improved performance as the mental-physical and the physical-physical.

Thiffault's study (1974) with young boys in an organized ice hockey program showed effectiveness in improving visual perception and visual discrimination.

The other gross motor tasks studied were: throwing at a target (Stebbins, 1968), rope skipping (Rapp, 1973), ring toss (Twining, 1949), and a novel paddle/ball/target task (Egstrom, 1964). The results of all of these revealed significant positive effects on skill performance after mental practice. Oxendine's study (1969) with the soccer kick, jump shot, and pursuit rotor also demonstrated significant positive effects from mental practice. The effectiveness of utilizing mental practice shows no clear trend in these studies with complex-gross and complex-fine motor skills.

#### Other Research

The potential influence of practice sequence and individual abilities cannot be ignored in mental practice research. The results of research related to these factors are reported in the paragraphs below.

Sequences and combinations of practice. Stebbins (1968) conducted a study primarily to determine sequences

of mental and physical practice. He tried different combinations of mental, mental-physical, and physical-mental, along with control and physical practice groups. The task was throwing rubber balls at a target, and the subjects were college males. The only significant improvements were in the combination treatments. Either mental or physical practice was effective during the first half of skill development. The familiarity of the task may have contributed to the "no difference" of the combination practice from the physical practice.

Welsh (1971) studied the effects of interpolating mental practice on learning and retention of ring tossing. His results showed no advantage of physical-mental-physical sequenced groups over physical-physical-mental or mental-physical-physical. Thus, in these two studies, combination treatment was effective but no combination was more effective than another.

Ability factors and mental practice. Start (1960, 1962, 1964a, 1964b) has conducted several studies to determine the relationship between various ability factors and improvement in motor skills by utilizing mental practice. Two of these studies (1964a, 1960) looked at the possible relationship between intelligence and mental practice. The first of these (1960) used the underhand basketball free throw as the task with twelve-year-old English boys as the subjects. The

mean IQ was 103.8--those not testing high enough for secondary grammar school in England. The study consisted of a pretest and a posttest with nine sessions of five minutes each of mental practice. Start concluded that there was significant improvement in the mean final score, that the improvement was not related to the initial score or intelligence, and that the test did not have a discriminating scoring procedure. The test consisted of ten free throws and only the baskets made counted.

In the second study (1964a), concerning intelligence as a factor in mental practice, Start again failed to find a significant correlation between the two. This study spanned just six days with college male subjects on a simple gymnastic skill, the single leg upstart. The mental practice took place five minutes per day for six days. Oxendine's study (1969) showed no relationship between intelligence and ability to benefit from mental practice. The subjects were junior high school boys and the mean IQ was 113.8.

Start (1962) conducted a study to look at games ability and gain on a motor performance task after mental practice. The group which was rated high (one rater used) on games ability in four different sports had a significant difference in means of initial and final scores on a basketball free throw test. The mental practice



sessions were five minutes daily for nine days. The average and low rated group means (on games ability) showed no significant difference.

Start and Richardson (1964) used the single leg upstart to look at the relationship between imagery and mental practice. Vividness and autonomy of imagery were tested according to an image inventory. It appeared that vividness of imagery was associated with low criterion scores.

Richardson (1967a, 1967b) submitted a two-part review and discussion of mental practice research covering the first thirty years of investigation into this area of study. In summarizing individual variables which have been studied, he cited: abstract reasoning, games ability, imagery, intelligence, kinesthesia, mechanical reasoning, motor ability, selective attention, sex, and spatial relations. Of these, he suggests that the findings for motor ability and games ability are difficult to interpret. In addition, further study is needed to investigate the possible interrelationship among selective attention, imagery (position memory), and spatial relations, since these were the only variables which showed a significant relationship to gain from mental practice.

Since Richardson's review in 1965, Wilson (1960) investigated spatial relations, abstract reasoning, and

mechanical reasoning as abilities which might affect success with mental practice. She concluded that these factors did not contribute to improvement in skill with any of the practice combinations.

In studies of referenced measures external to the practice task (e.g., spatial relations, verbal ability, perceptual ability, etc.), Fleishman (1972) found that as practice continues, changes occur in the particular combinations of abilities which contribute to performance. One of the changes noted was that the contribution of nonmotor abilities (e.g., spatial, verbal), which play a role in early learning, decreases with practice relative to motor abilities.

In summary, research on ability factors and their affect on mental practice success has been performed in a variety of settings. Typically, complex skill learning has been involved. Start's several studies (1960, 1962, 1964a, 1964b) concluded that while there was significant improvement, the improvement was not related to intelligence. Oxendine (1968, 1969, 1972) likewise concluded that there was no relationship between intelligence and the ability to benefit from mental practice. Richardson, in his study of the first thirty years of mental practice research (1967a, 1967b), reported that the findings for motor and games ability are difficult to interpret. He also stressed the need for additional study to investigate



possible relationships among other factors, e.g., selective attention, imagery, and spatial relationships. Some of the investigations recommended by Richardson subsequently were done by Wilson (1960) with the conclusion that these factors did not contribute to skill improvement.

Thus, there is no evidence at this time that individual abilities, including intelligence, are significant in mental practice research. However, it is an area of research in mental practice which remains open to more substantive research and investigation.

#### Theories on Mental Practice Effectiveness

Several reasons for the apparent effectiveness of mental practice of physical skills have been suggested. Sage (1971) offers the following possibilities: motivation is increased, at least temporarily; a gain in perceptual insights occurs; there may be an effect due to slight action potential in the muscles (neuromuscular theory); and many of the neural components in the brain which direct actual movements are activated in mental practice (neurophysiological theory).

In Part II of his review of mental practice research, Richardson (1967b) discusses possible hypotheses to account for the apparent effectiveness of mental practice. He suggests that there could be a motivational

effect of mental practice rather than a learning effect which has not been ruled out, nor has the possibility of task sophistication (comparable to test sophistication). He then offers what he calls a psychoneuromuscular explanation based upon the action currents produced in appropriate muscle groups as one imagines himself through a particular movement, experiences kinesthetic feedback, and makes corrections. Several studies are cited which provide some support for this attempt to explain the positive results of mental practice (Ulrich, 1967).

#### Summary of Review of Research

The approaches to the study of mental practice as it relates to learning and performance of motor skills were numerous. Variety was evident in experimental situations, sequencing of mental practice with physical practice, duration of mental practice sessions, length of the studies, measurement of performance, analysis of learning curves, types of skill tasks used (fine, gross, simple, complex, open, closed, discrete, continuous), skill level of subjects, and the statistical treatment of data.

It is difficult to find trends in the relatively few studies which have been reported. There is one conclusion that appears to be valid. Mental practice or conceptualizing of the task does result in improved performance. Early studies involving structured mental

practice and, in particular, the studies of Thiffault (1974), Egstrom (1964), and Oxendine (the pursuit rotor study, 1969) are important. Egstrom and Oxendine both found that a combination of physical and mental practice produced gains equal to or better than other groups with less physical practice time. Ulrich's study (1967) reported that the alternation of active (physical) and mental training was more successful in most groups than only active training.

In situations where subjects have had some pre-task experience and no further physical practice before the criterion task (Corbin, 1967a), scores were improved. The reasons for the effects are not, however, clear. Nor are the studies conducted thus far clear about retention.

A variety of types of skills seems to be amenable to mental practice. However, the more complex skills may be more of a challenge and, therefore, more interesting to practice mentally.

The studies summarized earlier indicated that structured mental practice was superior to unstructured mental practice. The amount and content of structure varied.

This review of the research literature has not indicated that individual ability, skill level of learner, or age are important discriminating factors in mental practice. The research which has investigated these factors remains inconclusive.

## CHAPTER III

### METHODOLOGY

This study was concerned with the effect of mental practice on both performance and form in learning two complex tennis skills: the forehand and the service. The term "performance" used in this study referred to accuracy measured by objective skill tests. The term "form" used in this study referred to the rating of subjects on criteria selected for acceptable stroke patterns.

Prior to the formal collection of data, a pilot study was conducted in two beginning tennis classes during the fall term of 1976. The purpose of the pilot study was to determine appropriate performance criterion tests and to develop procedural techniques for the use of prepared audio tapes.

This chapter will discuss the selection of tests, the pilot study, and the methodology for the final study.

#### Review of Performance Tests

Hewitt's Tennis Achievement Test (1966) was initially favored for testing the forehand and the

service. His forehand test measured accuracy; his service test measured both speed and accuracy (Appendix A, Exhibits A and C).

Hewitt's forehand test required the student to stand at the baseline and drive balls over the net into zoned areas to score points. The balls were delivered by the instructor who stood at the service line across the net. The student needed to move into proper position for the forehand. Stroked balls landing nearer the opposite baseline and inside the court were scored higher than those clearing but landing nearer the net. Stroked balls going over a seven-foot restraining rope, placed above the net, received one-half the value of the zone in which they landed. Netted balls were scored zero and let balls were repeated. Ten trials were given after a ten-minute warmup and five practice trials.

Hewitt's service test required the student to serve ten balls into the right service court from behind the baseline. The serve was scored on both placement and speed. For placement, the far inside corner of the right service court, six feet deep and three feet wide, was divided equally into the four highest scoring areas. The deep area to the left of this square, six feet deep and ten feet six inches wide, was given the next highest value. The entire forecourt of the service area, fifteen feet by thirteen feet six inches, had the lowest value.



To score on speed, the ball first had to land somewhere in the service court. Speed was then measured by the distance of the second bounce. Four zones were marked, beginning with the backcourt area of the playing court and extending to three scoring zones beyond the baseline. The area farthest beyond the baseline scored highest. Zero points were given for a serve going over the seven-foot restraining rope.

Hewitt's test was selected for the pilot study for the following reasons:

- (1) Objective measurement of forehand and service performance;
- (2) Reliability and validity (the reliability of the Hewitt tests for ninety-one beginners, thirty-six advanced, and sixteen varsity/junior varsity players combined was .75 on the forehand, .94 on the service placement, and .84 on service speed based on the "test-retest" method. The validity coefficient based on a comparison with rank order of playing ability of ninety-one beginners was .67 for the forehand, .72 for service placement, and .89 for service speed) (Hewitt, 1966);
- (3) Realistic game application (the test required ball tracking, positioning, and stroking in a

physical space which provided gamelike perspective);

- (4) Reasonable administrative time (could be completed in one class period);
- (5) Ease of administration.

For the forehand, an objective test which would measure controlled, accurate stroking, and which was similar to the game situation was sought. Hewitt's test met the criteria selected for this study. Hewitt's service test measured the two factors important for a beginner's serve, speed and accuracy, and was less time consuming than DiGennaro's test (1969).

The other tennis skill tests reviewed for consideration were Dyer's revision of her original Backboard Test of Tennis Ability (1938), Hewitt's Revision of Dyer's Backboard Test (1965), DiGennaro's Construction of Forehand Drive, Backhand Drive, and Service Tests (1969), and the Broer-Miller Achievement Tests for Beginning and Intermediate Tennis (1950).

Both Dyer (1938) and Hewitt (1965) (Hewitt's revision of Dyer's test) measured the number of hits against a backboard in a given amount of time. The forehand and the backhand could be used. There were limitations in terms of the height at which the ball had to hit the wall, and a restraining line behind which

the stroke had to be initiated. Neither of these tests was appropriate for this study since backboard practice was not a formal part of the forehand practice mode planned for the classes nor was speed of stroking a major emphasis (Safrit, 1973). Fox (1953) conducted a study which indicated that a combination of the Dyer revised test and the Broer-Miller test had acceptable validity for beginners, but only if backboard practice had been included in the instruction.

The Broer-Miller test (1950) utilized a self-tossed ball which was stroked with the forehand after one bounce. While useful in the initial stages of ground stroke (forehand and backhand) learning, this task would not accommodate discriminate assessment of the control and form emphasized in the present study. Except for slow learners, self-toss drills for the forehand would not be used beyond the second lesson in college classes.

The tests considered for assessing performance on the service were Hewitt's test (1966) and DiGennaro's test of the forehand, backhand, and service (1969). DiGennaro's test was not practical because of lengthy administration time.

### Pilot Study

#### Subjects

The subjects were thirty-one undergraduate college men and women who were enrolled in two classes

in beginning tennis during the fall term, 1976, at Kalamazoo College. These students elected tennis from twenty-one different activities offered during this term to meet the requirement in physical education.

### Tests

The Hewitt forehand test (1966) was administered during the second class period of the term to collect pretest scores on performance (accuracy) of the forehand. The same test was given during the sixth class period for immediate posttest scores. During the tenth and fourteenth class periods, Hewitt's service test was administered to obtain pretest and immediate posttest service performance scores.

### Schedule

Each class met twice weekly for fifty minutes in the ten-week term. During the three days between the pretest and immediate posttest on both the forehand and service, instruction was given for each skill. Instruction in both classes was the same for all students. Hewitt's tests for both skills were again administered during the last two class periods of the term as final posttests. Backhand instruction was given in the seventh, eighth, and ninth lessons, as normal beginning tennis class content, but this skill was not included in the study. Lessons fifteen through eighteen included all three strokes.

### Treatment

One class was selected to receive additional practice, in the form of mental practice, to supplement the three lessons on each of the two skills. Mental practice was directed through the medium of audio tapes placed on closed reserve in the college library. All students in one class were assigned to listen to Tape 1 on the forehand after lesson one and before lesson two; Tape 2 after lesson two and before lesson three; and Tape 3 after lesson three and before the immediate post-test.

The procedure for the service tape listening was the same. The control class received no additional assigned practice. No further tape listening was assigned.

The tape content for both the forehand and the service was essentially the same as the content for the MPP (mental practice positive) group in the final study (Appendix B, Exhibit A). This content included all instructional cues and sequences for stroke patterning and ball tracking, as presented in class.

In the pilot study, skill acquisition was measured only by performance (accuracy) scores. These data were obtained through use of Hewitt's objective tests of the forehand and the service (1966). Prepared audio tapes were used to direct mental practice as a

supplemental treatment to class instruction. Lessons in both classes were the same for all students. A total of forty-five minutes of mental practice, for each of the two skills, was expected of all students in the treatment groups. The control group received no additional assigned practice.

#### Changes Resulting from the Pilot Study

The pilot study was useful in determining necessary modifications of the objective performance tests and in clarifying the procedure for using audio tapes as the mental practice mode. A third value of the pilot study was the realization that assessment of skill acquisition could not be adequately measured solely by objective tests. It was apparent, by observation of skill patterns during the final posttest performance tests, that positive changes in patterning were occurring. These changes needed to be evaluated to more fully assess learning.

#### Revision of Performance Tests

Hewitt's test for the forehand (1966) was revised for the final study as follows:

1. The height of the rope stretched across the net was changed from seven feet to nine feet six inches. Students in beginning tennis were

instructed to stroke the ball so that it cleared the top of the net by three feet to six feet. Since the net itself was three feet high, an additional six feet were believed necessary to be consistent with instruction.

2. Rather than giving one-half point for balls going over the rope and full points for those going between the rope and the net, full points were given for any ball which went over the rope, and double the value for any ball which went between the rope and net into a scoring area. This change was made to be consistent with the change in rope height and to reward or encourage the student. The scoring change was made to avoid fractions.
3. To remain consistent with instruction without penalizing the subject, the markings in the backcourt and forecourt were changed (Appendix A, Exhibit B). A scoring area was added beyond the baseline. It was important to recognize and encourage depth in ground stroke production. If beginners being tested feared stroking the ball too long and getting a zero on an otherwise good stroke, they might alter their pattern to avoid such penalty.

4. The ten-minute warmup period for the forehand was eliminated and the five trials retained.
5. Ball machines were used to provide more consistent ball speed, flight, and bounce.

Revisions of the service test for the final study were as follows:

1. The service court was left intact as one scoring area. The small scoring area in the deep inside corner of the service court, which was a part of Hewitt's test, was deleted. On advice from tennis professionals, it was agreed that this was a small target for beginners. Any serve landing in that small area would be by chance and should not receive additional weight in scoring.
2. The rope above the net was not used. Again, to be consistent with instruction and to discourage the beginner's tendency to hit down on top of the ball, the rope was removed.

#### Procedural Changes

The immediate posttests after three lessons were eliminated. Insufficient practice had occurred between pretests and immediate posttests to develop improved



performance. As a result, the mental practice schedule was extended throughout the ten weeks from pretest to posttest.

Intact classes were not used as treatment groups, but students across classes were randomly assigned to treatments. The MPP (mental practice positive) treatment was retained, and a different mental practice content was developed. The new mental practice content was MPEIEE (mental practice with error identification, error experience, and error elimination). The development of the MPEIEE tapes was directed toward reducing trial and error time when the students were in class. Any error concepts which could be identified through the tapes and removed mentally by the learner would allow more physical practice time in class to repeat correct stroke patterns.

#### Additional Measurement

Class instruction emphasized stroke patterns. In the pilot study, students were not measured on this. The decision was made, therefore, to include video tape ratings (pre and post) on each subject to establish a rating on form. Thus, skill acquisition was not only measured on the performance tests, but also on ratings of stroke patterns. The data for a global analysis from rater impressions were collected from the raters' judgment on each rating sheet as to whether they were viewing pretest or posttest film.

## Methodology

### Subjects

The subjects were fifty-four undergraduate college men and women who were enrolled in three classes in beginning tennis during the winter term, 1977, at Kalamazoo College. Tennis is one of the many sports in which instruction is offered to the college students to provide them with activities through which they can meet the six-term physical education requirement for graduation.

### Schedule and Class Treatment

Each class met twice weekly for ten weeks with forty-five minutes of instruction per meeting. The first class meeting was devoted to orientation and explanation of the study. Class periods two and three were used for pretesting; class periods eighteen and nineteen were used for posttesting. The last class period was reserved for testing any subjects who were absent on either post-test day. The remaining fourteen class periods involved three days of instruction each on the forehand, service, and backhand--in that order--and then instruction on all of the three strokes on the remaining five days (Appendix F).

Techniques from Murphy (1975), Murphy and Murphy (1975), and Barnaby (1975) on drills and stroke pattern concepts were reviewed for task analysis and utilization of class time. Instruction included demonstrations,

explanations, and drill practice on the three strokes. Students worked at various times alone, in pairs, or in groups of three or four. Partners and groups were not assigned.

For the forehand, the drill progression was mimetic without the racket, mimetic with the racket, self-toss and stroke the ball into the curtains, self-toss and stroke the ball over the net, partner-toss and stroke the ball into the curtains, partner-toss and stroke the ball over the net, and stroking balls tossed by the ball machine. For the service, the drill progression was mimetic with the racket and without the ball, stroke with the ball toss and hit into the curtains, and then the full service stroke of the ball over the net. After the first few trials on each skill, the method of teaching was individual instruction.

There was no identification of students with treatment groups during class instruction except with the added physical practice group (APP) which stayed for fifteen minutes after class. During this time, no instruction was offered.

### Procedure

The instructional services department at Kalamazoo College was consulted one month prior to the beginning of testing. Schedules for video taping were confirmed and the location of the cameras for filming

determined. The decision not to film at court level was reached after an examination of the area confirmed that both cameras could not be placed at similar locations with respect to the subjects. The circulations librarian at the college library was consulted and familiarized with the use of the audio tapes in relation to the study.

Both courts were marked identically with masking tape (Appendix A, Exhibits B and D). A Prince ball machine was used on one court and a Lobster ball machine on the other court. The machines were pretested and adjusted to eject a ball every five seconds. The speed and loft of the ball were matched and adjusted to allow the subject adequate time to assume a ready position before each stroke. The speed, loft, and frequency were the same for pretesting and posttesting. New balls were used for the pretest and the posttest. The balls used for the pretest were used for class instruction during the last two and one-half weeks before the posttest.

The reliability of the raters was established on a rating of ten women junior varsity players. The raters viewed the subjects' forehand and service strokes from the window where the camera for video taping was to be installed for the study. The conditions of the performance test of the study were simulated, and the rating sheets for the study were used (Appendix E, Exhibits A and B). The reliability of the raters on the forehand

was .75; on the service, .69. Reliabilities in the study would be at least this high given the likely greater variance in performance for these study data.

During the first class period, the students were told that a study would be conducted during the term to investigate effective ways of learning motor skills. They were told the amount of additional time which would be required and were given the option of participating or transferring to another class.

A brief explanation of the study and the students' involvement was stated. Names of all those who could stay for fifteen minutes after each class for added physical practice were requested and obtained. No further explanation was given, and the pretest for the second class period was announced.

Each subject was assigned a testing number for the pretest which was printed on one-half of folded eight-inch by fifteen-inch poster boards which stood on edge on the court surface. The number for each subject, then, was visible to the TV cameras for subject identification by the raters. Different numbers were assigned each subject for the posttest.

Two TV cameras were placed in a classroom window, thirty feet above the courts. The window ran parallel to the sidelines and was even with the service line on the opposite end of the court from the subjects.

Both camera operators were familiarized with the tests and started filming at the beginning of each subject's trials (not including practice trials). Twelve fifty-minute video tapes were used. Two students in each class were assigned to turn the ball machines on and off at the appropriate times. They also collected balls and loaded the machine for each subject. Signs were posted and a student was assigned to the door of the tennis courts to prevent anyone from entering during testing. All subjects remained seated on the sidelines throughout testing.

Upon the completion of pretesting during the second class meeting, each subject received a prepared instruction sheet on which had been placed his/her treatment group identification. This sheet included class requirements for credit and a schedule for audio tape practice. Each subject in the three mental practice groups--MPP, MPEIEE, and PMP--was to listen to the tapes as scheduled. The APP group was assigned an equivalent time for added physical practice at the end of the instructional periods (Appendix D).

During the term, students were reminded at the end of each class period to listen to the appropriate tape before the next class period, according to the schedule provided them. Each student was requested to listen a total of ten times (150 minutes), fifteen

minutes at a time. The closed reserve checkout cards at the library were examined each week, and the listening times for each student were recorded. Those students who fell behind in listening were reminded each week.

#### Pre-Study Data

Verbal scores from the Scholastic Aptitude Test of the College Entrance Examination Board were obtained for all subjects. The scores were rank ordered and the median score of 550 was determined with a range from 690 to 280. Those subjects above the median were placed in the high verbal group and those below the median were placed in the low verbal group for the study.

The thirteen students required for the APP (added physical practice) group were randomly selected by high/low verbal classification from a limited number of students in each class who could stay after class. Students were then randomly assigned within each class and high/low verbal combination to the three treatment groups (MPP, MPEIEE, and APP) and one control group (PMP).

#### Collection of Data

Collection of pretest and posttest data was identical. Pretest data on the forehand were collected the second class period, and for the service, the third class period. Posttest data were collected the

eighteenth and nineteenth class periods. The last class period was arranged to test anyone absent on previous posttest days (Appendix C). All tests and class instruction were conducted on the two indoor college tennis courts which are of a commercial tennis composition surface. A trained assistant and the experimenter administered and scored all performance tests. During the performance tests, each subject was video taped throughout all trials to secure film data for form ratings.

The subjects' testing numbers--two for each subject (pre and post)--were placed in random order according to a table of random numbers. The original pre and post video films were then placed in random order onto new tapes. The pretest and posttest forehands were randomized on separate tapes from the pretest and posttest service. The randomization of pretest and posttest films kept the raters naive as to which films were pretest and which were posttest. These tapes were then submitted to two outside raters who did not know the students for assessment of pretest and posttest form. The raters were two experienced tennis professionals and former USTA ranked players. They were asked to rate the subjects on particular criteria (Appendix E).



### Treatment

Eighteen mental practice audio tapes were prepared by the experimenter. The length of each tape was from twelve to fifteen minutes (Appendix B). A series of three audio tapes each for the forehand and the service was prepared for all mental practice groups as follows:

|        | Forehand | Service |
|--------|----------|---------|
| MPP    | 3        | 3       |
| MPEIEE | 3        | 3       |
| PMP    | 3        | 3       |

The MPP and MPEIEE tapes followed in sequence the instructional material from classes. For instance, Tape 1 contained material from lesson one; Tape 2, lesson two; and Tape 3, lesson 3. The tapes were labelled for proper identification and placed on closed reserve in the college library. Close control over the signout procedure assured that the subjects received the correct tapes (Appendix F).

#### MPP Tape Content (mental practice positive):

All instructional cues and sequences for stroke patterning and ball tracking, as presented in class, were reiterated again and practiced on the MPP tapes. Only correct patterns were described.

MPEIEE Tape Content (mental practice with error identification, error experience, and error elimination): The MPEIEE tapes included, in part, the correct pattern content of the MPP tapes. They emphasized, however,

information concerning common errors, the prevailing causes of these errors, mental trial of errors, and information and practice time needed to correct these errors. The correct pattern was always practiced after the errors were mentally perceived.

PMP Tape Content (placebo mental practice):

The content of the placebo tapes contained correct but useless (for the study criteria) information for beginners about strokes, strategy, and how to watch tennis matches.

The APP group (added physical practice) received added physical practice time. This group had no mental practice.

The three treatment groups were the two mental practice groups (MPP and MPEIEE) and the added physical practice group (APP). Placebo mental practice (PMP) was the control group. All groups had add-on treatment beyond the class instruction. The class instruction was the same for all groups.

Statistical Treatment

A two-way completely crossed multivariate analysis of covariance was applied to each of two sets of data. The data for the forehand and the service were treated separately.

The purpose of these analyses was to test the following null hypotheses:

Null Hypothesis 1:

There will be no significant difference between treatment groups on improvement in performance and form on the forehand and service.

Null Hypothesis 2:

There will be no significant treatment by high/low verbal ability interaction.

Multivariate analysis of covariance can be applied when concomitant variables (covariables) are added to a model to determine if there are significant main effects which cannot be attributed to the covariable (Press, 1972). The pretests in this study were used as the covariables to control variations which would exist because of differences in initial skill level of the subjects and thus to provide more powerful tests of the hypotheses.

The independent variables were treatment condition, section, and high/low verbal ability (see Table 1). The dependent variables were form and performance on both the forehand and the service. The covariates were the same as the dependent variables except that they were pretests. If the multivariate test of interaction were significant, separate univariate analyses of covariance would be of interest to identify the treatment(s) interacting with verbal ability.

A 4 x 2 randomized design was used for statistical treatment of the data. There were four treatment levels,

TABLE 1  
RANDOMIZED DESIGN

| Class<br>Sections                         | SAT<br>Verbal Score | Treatment Conditions |              |           |           |
|-------------------------------------------|---------------------|----------------------|--------------|-----------|-----------|
|                                           |                     | T1<br>MPP            | T2<br>MPEIEE | T3<br>APP | T4<br>PMP |
| Section<br>1                              | High                | 3                    | 3            | 2         | 3         |
|                                           | Low                 | 2                    | 2            | 2         | 1         |
| Section<br>2                              | High                | 2                    | 2            | 3         | 2         |
|                                           | Low                 | 3                    | 3            | 3         | 4         |
| Section<br>3                              | High                | 2                    | 2            | 1         | 1         |
|                                           | Low                 | 2                    | 2            | 2         | 2         |
| Number of Subjects<br>in Treatment Groups |                     | 14                   | 14           | 13        | 13        |

two verbal ability levels, and three sections of the class. The section variable was dropped from the design for analysis because of attrition. The significance level for hypothesis testing was set at the .05 ( $p = .05$ ) level.

A discussion of the analysis of the data, which was generated from the design shown in Table 1, will follow in Chapter IV. The data were analyzed at Michigan State University using the FINN computer program of multivariate analysis of covariance on the CDC 6500.

## CHAPTER IV

### ANALYSIS OF THE DATA

The purpose of this study was to determine the effect of two types of mental practice on the learning of two complex tennis skills: the forehand and the service. This chapter will discuss subject attrition, the research design, presentation of the data, and summary of the results.

#### Subject Attrition

The original sample in three beginning tennis classes consisted of fifty-four subjects. Two of these subjects withdrew from their classes after four weeks and were dropped from the study. All data were collected on the remaining fifty-two subjects. Of these fifty-two subjects, forty-four fulfilled the minimum mental practice treatment time. The minimum treatment time was set at six tape sessions which included listening to each of six tapes at least once. All subject attrition occurred in two treatment groups: one experimental group (MPP) and the control group (PMP). Since subject attrition

occurred in one experimental group, resulting in a 50 percent attrition in this group (MPP), the data were analyzed both for the initial sample (Sample I,  $N = 52$ ) and the retained sample (Sample R,  $N = 44$ ). Subject attrition also resulted in the removal of sections as an independent variable (see Table 1, page 52).

### The Research Design

The choice of the multivariate analysis of covariance design for this study is appropriate. The experiment contained an extraneous source of variation, initial skill level, which might have affected the dependent variables but was not relevant to the objectives of the study. It was possible to obtain a measure of this source of variation by pretesting both the forehand and the service on performance and form. The pretest scores functioned as the covariables. The design thus provided statistical control over this source of variation which could not be controlled experimentally. For the complete sample the covariables should improve statistical power. For the reduced sample the covariables help to control confounding introduced by attrition.

Differences in ability to benefit from learning through mental practice were hypothesized to be related to verbal ability. Verbal ability was, therefore, considered a possible intervening variable and was tested for interaction with treatment effects.

The assumptions of multivariate analysis of covariance were not tested in any formal sense. Multivariate analysis of covariance is robust to violations of the assumption of normality and equal variance for balanced or near balanced designs. While the complete sample design was near balanced and made for robust tests of hypotheses, the reduced sample was not. Nevertheless, the results of analysis of the reduced sample mirrored those of the complete sample and were, therefore, not suspect. Meeting the assumption of independence was facilitated by random assignment and by the individualized nature of the treatments. Meeting the assumption of parallel regression lines was facilitated by including in the design the variable believed most likely to interact with treatment. Furthermore, analysis of covariance has been shown to be quite robust with respect to the parallel regression lines assumption.

#### Presentation of Results

The data will be presented and discussed relative to the multivariate analysis of covariance test of significance and then the gain scores on the observed combined means will be presented. Correlations between the variables and a discussion of the analysis of raters' impressions will conclude the presentation.

Two separate multivariate analysis of covariance tests were conducted, one for the forehand and one for



the service. The data analysis revealed that the first null hypothesis, that there would be no significant difference in treatment groups on improvement in motor skill learning, was not rejected at  $\alpha = .05$ . These data also show that verbal ability was not a significant factor in utilizing mental practice. Thus, the second null hypothesis of no treatment-verbal ability interaction was not rejected (Tables 2 and 3).

Some observations on the slight mean differences between treatment groups should be noted. These differences were considered using gain scores. ANCOVA using pretests as covariates and posttests as dependent variables is identical with ANCOVA using gain scores as dependent variables and pretests as covariables. Thus, the results for gains are as given in Tables 2 and 3. The added physical practice group (APP) is slightly better on forehand performance (Table 4). Their gain is better than the other three groups. The APP group was also affected less by change on service performance (Table 7). It should be noted, however, that both the pretest and posttest mean scores for this group were the lowest. On service form, the APP group and the MPEIEE group were slightly better than the other two groups in gain (Table 6). Their posttest mean scores are comparable with the other two groups even though

TABLE 2

F-RATIO FOR MULTIVARIATE ANALYSIS OF COVARIANCE--FOREHAND

| Hypotheses                      | Sample I | Sample R | Sample I<br>r | Sample R<br>r |
|---------------------------------|----------|----------|---------------|---------------|
| Treatment                       | .51      | .38      | <.80          | <.89          |
| Verbal Ability                  | .03      | .03      | <.97          | <.97          |
| Verbal-Treatment<br>Interaction | .76      | .58      | <.60          | <.74          |

d.f. = 24

TABLE 3

F-RATIO FOR MULTIVARIATE ANALYSIS OF COVARIANCE--SERVICE

| Hypotheses                      | Sample I | Sample R | Sample I<br>r | Sample R<br>r |
|---------------------------------|----------|----------|---------------|---------------|
| Treatment                       | .64      | 1.07     | <.69          | <.39          |
| Verbal                          | .05      | .09      | <.95          | <.92          |
| Verbal-Treatment<br>Interaction | .78      | .85      | <.58          | <.53          |

d.f. = 24

TABLE 4

OBSERVED COMBINED MEANS--FOREHAND PERFORMANCE, SAMPLE I

| T <sub>1</sub><br>MPP |       | T <sub>2</sub><br>MPEIEE |       |       |      | T <sub>3</sub><br>APP |       |       |  | T <sub>4</sub><br>PMP |       |      |  |
|-----------------------|-------|--------------------------|-------|-------|------|-----------------------|-------|-------|--|-----------------------|-------|------|--|
|                       |       | PreP                     | PostP | Gain  |      | PreP                  | PostP | Gain  |  | PreP                  | PostP | Gain |  |
| 25.75                 | 33.58 | 7.83                     | 23.71 | 31.79 | 8.08 | 23.54                 | 35.31 | 11.77 |  | 25.08                 | 33.77 | 8.69 |  |

Note. Critical value is 3.18; maximum possible score is 80.

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TABLE 5

OBSERVED COMBINED MEANS--FOREHAND FORM, SAMPLE I

| T <sub>1</sub><br>MPP |       | T <sub>2</sub><br>MPEIEE |       |       |       | T <sub>3</sub><br>APP |       |       |  | T <sub>4</sub><br>PMP |       |      |  |
|-----------------------|-------|--------------------------|-------|-------|-------|-----------------------|-------|-------|--|-----------------------|-------|------|--|
|                       |       | PreF                     | PostF | Gain  |       | PreF                  | PostF | Gain  |  | PreF                  | PostF | Gain |  |
| 17.08                 | 25.17 | 8.09                     | 13.93 | 24.36 | 10.43 | 16.31                 | 26.69 | 10.38 |  | 16.69                 | 23.23 | 6.54 |  |

Note. Critical value is 3.18; maximum possible score is 35.

TABLE 6

## OBSERVED COMBINED MEANS--SERVICE FORM, SAMPLE I

| T <sub>1</sub><br>MPP |            | T <sub>2</sub><br>MPEIEE |             | T <sub>3</sub><br>APP |             | T <sub>4</sub><br>PMP |            |
|-----------------------|------------|--------------------------|-------------|-----------------------|-------------|-----------------------|------------|
| PreF                  | PostF Gain | PreF                     | PostF Gain  | PreF                  | PostF Gain  | PreF                  | PostF Gain |
| 20.50                 | 25.92 5.42 | 13.21                    | 28.21 15.00 | 14.00                 | 27.38 13.38 | 21.23                 | 28.15 6.92 |

Note. Critical value is 3.18; maximum possible score is 35.

TABLE 7

## OBSERVED COMBINED MEANS--SERVICE PERFORMANCE, SAMPLE I

| T <sub>1</sub><br>MPP |             | T <sub>2</sub><br>MPEIEE |             | T <sub>3</sub><br>APP |            | T <sub>4</sub><br>PMP |            |
|-----------------------|-------------|--------------------------|-------------|-----------------------|------------|-----------------------|------------|
| PreP                  | PostP Gain  | PreP                     | PostP Gain  | PreP                  | PostP Gain | PreP                  | PostP Gain |
| 12.92                 | 11.17 -1.75 | 13.57                    | 10.50 -3.07 | 8.77                  | 8.92 0.15  | 12.08                 | 9.31 -2.77 |

Note. Critical value is 3.18; maximum possible score is 40.

their pretest mean scores were slightly less. All differences in treatment group means are slight for each dependent variable. While overall gain was not tested with the original design and data; since there were no effects for any independent variable in the original design, a quick and conservative test for overall group mean gain was used as an independent estimate of overall gain. A one-sample t-test of gain with four observations tests this hypothesis.

Significant gains resulted from improvement in forehand performance (9.09). See Table 4, page 59. Gains on form for both the forehand and the service were significant and positive (8.86--forehand; 10.18--service). See Tables 5 and 6, pages 59 and 60. Service performance for all treatments was not significantly different from zero (Table 7, page 60). While this may merely reflect the conservative nature of the test, it was nevertheless the case that sample gains for service performance were substantially smaller than gains for the other three dependent variables.

Correlations between the variables showed little relationship between pretest and posttest scores. The highest correlation (.538) was between preaccuracy and postaccuracy (performance) on the forehand (Table 8). The next highest correlation was between preaccuracy (performance) and postform on the forehand (.385, Table 8). The highest correlation between variables

TABLE 8  
SAMPLE CORRELATION MATRIX--FOREHAND SAMPLE I

|   |       | 1<br>PreF | 2<br>PostF | 3<br>PreA | 4<br>PostA |
|---|-------|-----------|------------|-----------|------------|
| 1 | PreF  | 1.000     |            |           |            |
| 2 | PostF | .281      | 1.000      |           |            |
| 3 | PreA  | .385      | .228       | 1.000     |            |
| 4 | PostA | .296      | .203       | .538      | 1.000      |

TABLE 9  
SAMPLE CORRELATION MATRIX--SERVICE SAMPLE I

|   |       | 1<br>PreF | 2<br>PostF | 3<br>PreA | 4<br>PostA |
|---|-------|-----------|------------|-----------|------------|
| 1 | PreF  | 1.000     |            |           |            |
| 2 | PostF | .333      | 1.000      |           |            |
| 3 | PreA  | .130      | .316       | 1.000     |            |
| 4 | PostA | .139      | .198       | .372      | 1.000      |

on the service was between preaccuracy and postaccuracy (.372, Table 9). Changes in these correlations on the analysis of the remaining sample (Sample R) were slight and mixed (Tables 10 and 11). The conclusion is that there is little relationship between pretest and posttest scores in this study. Future studies of this type would be advised to search for better covariates.

The global analysis of raters' impressions was of interest. The raters viewed and rated 208 tests of form. The pretest and posttest skill presentations on video tapes were randomized so that the raters did not know if they were rating pretest or posttest form. On each rating, in addition to rating the subject, they were asked to indicate if the film was pretest or posttest. In the analysis of their impressions each posttest film which they indicated was pretest was noted as an error. The data used for the analysis, therefore, represent 104 responses. The mean of the raters' wrong selection of posttests as pretests was then calculated. The percentage of error on the forehand was 22.1 and on the service, 13.5. In looking at the possible effects of treatment differences on the raters' impressions (Tables 12 and 13), it is apparent that the raters had the greatest number of errors (33%) on the forehand in the MPP group. Their lowest number of errors was on the control group (PMP) on the service. The greatest

TABLE 10

## SAMPLE CORRELATION MATRIX--FOREHAND SAMPLE R

|   |       | 1<br>PreF | 2<br>PostF | 3<br>PreA | 4<br>PostA |
|---|-------|-----------|------------|-----------|------------|
| 1 | PreF  | 1.000     |            |           |            |
| 2 | PostF | .187      | 1.000      |           |            |
| 3 | PreA  | .261      | .112       | 1.000     |            |
| 4 | PostA | .194      | .131       | .441      | 1.000      |

TABLE 11

## SAMPLE CORRELATION MATRIX--SERVICE SAMPLE R

|   |       | 1<br>PreF | 2<br>PostF | 3<br>PreA | 4<br>PostA |
|---|-------|-----------|------------|-----------|------------|
| 1 | PreF  | 1.000     |            |           |            |
| 2 | PostF | .411      | 1.000      |           |            |
| 3 | PreA  | .052      | .220       | 1.000     |            |
| 4 | PostA | .134      | .330       | .414      | 1.000      |



TABLE 12

## NUMBER OF POSTTEST RATINGS MARKED AS PRETESTS--FOREHAND

| Treatment Group | n  | Rater 1 | Rater 2 | Combined Error of Raters (Percentage) |
|-----------------|----|---------|---------|---------------------------------------|
| MPP             | 12 | 4       | 4       | .33                                   |
| MPEIEE          | 14 | 5       | 1       | .21                                   |
| APP             | 13 | 3       | 2       | .14                                   |
| PMP             | 14 | 2       | 2       | .19                                   |
| Total           | 52 | 14      | 9       |                                       |

TABLE 13

## NUMBER OF POSTTEST RATINGS MARKED AS PRETESTS--SERVICE

| Treatment Group | n  | Rater 1 | Rater 2 | Combined Error of Raters (Percentage) |
|-----------------|----|---------|---------|---------------------------------------|
| MPP             | 12 | 2       | 1       | .125                                  |
| MPEIEE          | 14 | 2       | 3       | .18                                   |
| APP             | 13 | 2       | 0       | .14                                   |
| PMP             | 14 | 4       | 0       | .08                                   |
| Total           | 52 | 10      | 4       |                                       |

difference between the raters' errors was with the MPEIEE group on the forehand (35%  $R_1$ ; 7%  $R_2$ ) and the APP group on the service (28%; 0%). Given the blind rating situation, the high percentage of correct impressions indicates that the criteria for rating form was discriminating in detecting change in form. The effect of treatment differences on the raters' impressions appears to be negligible.

#### Summary of Results

1. There was no significant difference in treatments on either performance or form for the forehand and the service.
2. There was no significant interaction between verbal ability and treatment on either performance or form for the forehand and the service.
3. All treatments resulted in significant improvement on form and performance of the forehand stroke.
4. All treatments resulted in significant improvement in service form but not in service performance.
5. Study results support earlier research which found that a combination of physical and mental practice was as effective for learning motor skills as physical practice alone.

## CHAPTER V

### RESULTS, LIMITATIONS, CONCLUSIONS, AND RECOMMENDATIONS

The purpose of this study was to investigate the effect of two types of mental practice on the learning of two complex tennis skills: the forehand and the service. The basic hypothesis, based upon a review of the related research, was that mental practice is an effective way to supplement physical practice when learning motor skills.

Little of the previous research was concerned with the use of mental practice in actual class settings. Further, the possibility for expediting concept formations, necessary to motor skill learning, appeared worthy of exploration in a classroom setting.

This chapter will discuss the results of the research with reference to the summary of reviewed research in Chapter II, the limitations of the research, conclusions from the study, and recommendations.

### Results of the Research

The results of the study were modest. They did, however, support much of the earlier research. Mental practice did result in improvement in learning. Gains were significant on all dependent variables except service performance. This was consistent with the results of many of the studies which have been reported (Clark, 1960; Wilson, 1960; Twining, 1964; Ulrich, 1967; Stebbins, 1968; Oxendine, 1969; & Rapp, 1973).

No significant difference in improvement was found between the two mental practice groups, the added physical practice group, and the control group. Wilson (1960), Egstrom (1964), and Oxendine (1969) (on the soccer kick and jump shot) also reported no significant difference in treatments. These studies found, as did the present study, that combinations of physical and mental practice were as effective as all physical practice.

There were results specific to this study which were of interest in the implications for future research. All treatments resulted in positive effects on improved forehand performance and form and service form. The effect on service performance, however, was not positive. The somewhat negative effect on service performance may have been a function of the task difficulty. Similar task interference was reported by Gilmore and Stolurow, 1951, and Jones, 1965. In both of these studies, the

interference was attributed to directed (structured) mental practice. Other studies utilizing structured mental practice, including this one, have, however, found positive effects (Gagné & Foster, 1949; Smith & Harrison, 1962; Egstrom, 1964; Thiffault, 1974; Whitehead, 1974). It is possible that the difficulty of the task (Oxendine, 1969; Lindquist, 1971) was the cause for the interference on service performance.

Verbal ability, as defined in this study, was not significant in facilitating learning of the motor skills. The hypothesis that those with high verbal ability would benefit from mental practice more than those with low verbal ability was not supported. The range of verbal scores may have been too restricted to have a discriminating effect. These results, therefore, support the null hypotheses:

Null Hypothesis 1:

There will be no significant difference between treatment groups on improvement in performance and form on the forehand and service.

Null Hypothesis 2:

There will be no significant difference between treatment groups by high/low verbal ability interaction.

The ability of the raters to identify pretest and posttest film of the service with greater accuracy than their impressions of pretest-posttest forehands is

of interest. Lindquist's (1971) analysis of the learning process using the tennis service as the task revealed that the learner attends to one variable in the pattern at a time. The learners in this study were attempting a correct pattern but were also trying to perform well on the objective test. The complexity of the service may have affected the performance on the objective skill test.

#### Limitations of the Research

1. The time of the study may have been too short to expect significant differences. The refinements of a complex skill occur over time with practice. All subjects had ninety minutes of practice per week in class. Three groups were receiving just one-third again as much extra practice as the control group. One-third more practice time at this stage of complex-gross skill learning might not be enough.
2. The treatment emphasized correct skill patterning in both the class and the added practice modes. While correct skill patterning could potentially result in better performance, this concentration on form could have lessened significant performance differences (Lindquist, 1971).

3. The control over mental practice is always subject to conjecture. Control in this study was as effective as possible under the conditions. Structured mental practice in class was not possible with the presence of all treatment groups in each class. Although most students checked the tapes out on closed reserve in the library, there is no way to know the extent of effort to conceptualize.
4. The time of a mental practice session may have had an effect. Some studies indicated that five minutes was maximum for concentration. It was the opinion in this study that the attention level could be maintained with college students for ten to fifteen minutes. However, some informal feedback reflected impatience with the slow motion rehearsal which was delivered at times on the tapes.
5. The time lapse between mental practice sessions alternating with physical practice sessions, which were separated by either two or three days, may have resulted in subjects forgetting mental practice tape content. A structure of mental practice or rehearsal followed immediately by physical practice or response might have had more effect.

6. Another possible limitation of this study has been noted by Lindquist (1971). The complexity of the skill tasks may have been too great for the mental practice to have had a significant effect on the performance of the service. The forehand is defined as an open type skill (Poulton, 1957), while the service is defined as a closed skill (Schmidt, 1975). Closed skills provide the subject with more control, but with beginners learning the service, there is considerable uncertainty and thus the service can be defined as an open skill. Therefore, the possibility that the effect of mental practice on learning the service would be effective was negated by the beginner's lack of control.

### Conclusions

This research extended the findings of earlier research which indicated that mental practice is an effective means for learning physical skills. The design of this research provided for the absence of systematic error in estimating treatment effects. Unbiased estimates were assumed since the subjects were randomly assigned to treatment conditions.

The limitations of the research have been discussed. There is small reason to suggest that the elimination or reduction of these limitations of the



research would have generated different results of the study. This could only be supported by replication of the study, and these preliminary findings do not argue persuasively for such replication.

#### Recommendations for Future Research

It is possible that the area of mental practice merits further investigation and research. Areas open to additional research are those assessing the factors of individual ability, the relationship of motivation to the effect of mental practice on learning, and a more precise determination of the time span necessary to learn a physical skill with and without a mental practice component.

The review of the related research for this study, the design and completion of the research, and the results were an effective task for learning about the relationship of mental practice to the learning of physical skills. This field of study remains one which could, with further related research, make a contribution to motor skill learning.

## **APPENDICES**

APPENDIX A

ACHIEVEMENT TESTS, TEST INSTRUCTIONS,  
AND SCORE SHEETS

APPENDIX A  
EXHIBIT A

HEWITT'S TENNIS ACHIEVEMENT TEST: FOREHAND

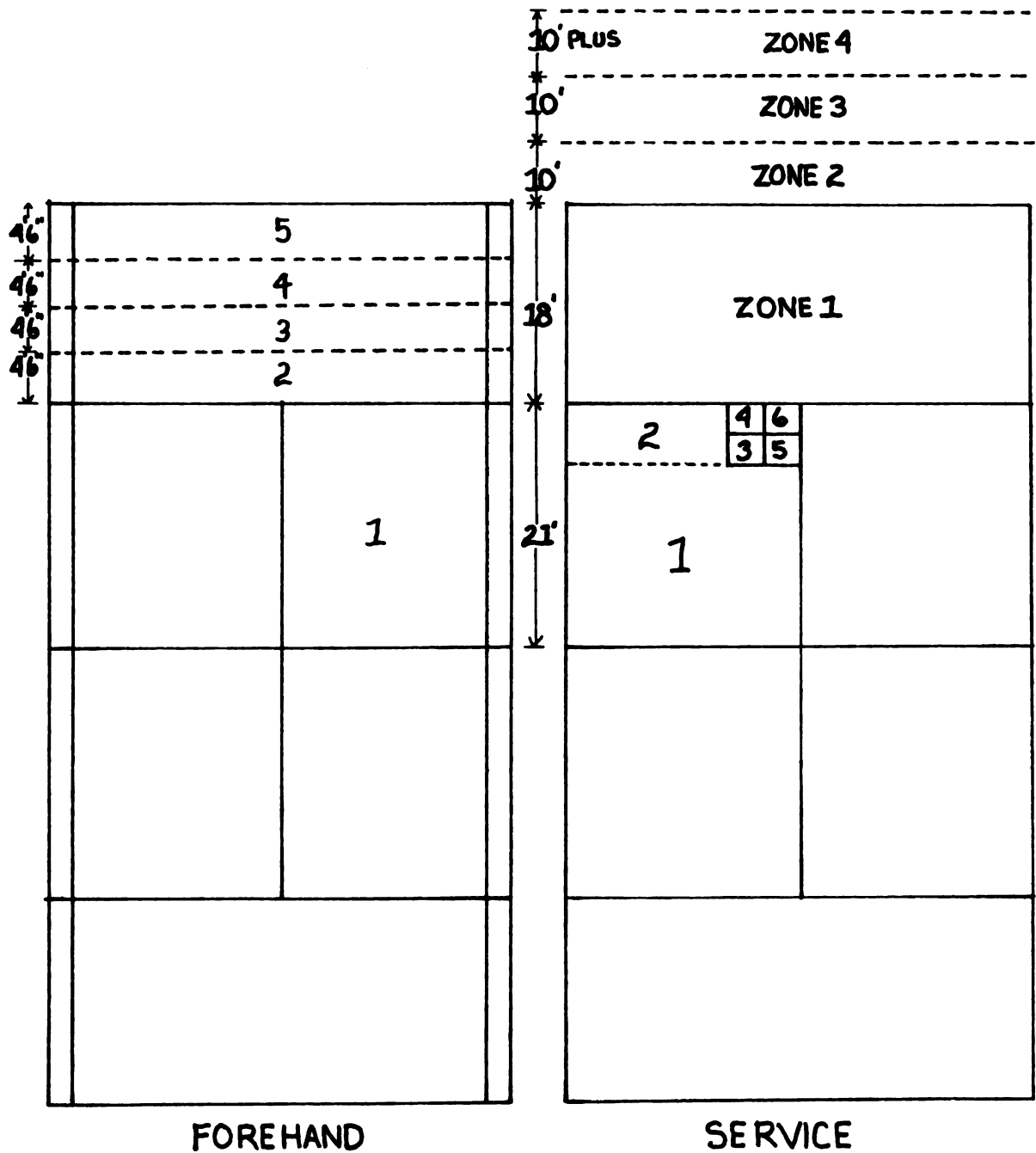
The test for forehand--

1. All groups are given a demonstration of the tests to be taken.
2. A 10-minute warm-up period is provided each student on another court prior to testing.
3. Student stands at the intersection of baseline at X while the instructor with basket of tennis balls places himself across the net at the intersection of the center service line and service line.
4. The instructor (using tennis racket) hits five practice balls to the students just beyond the service court. The student moves into proper position for the forehand, and drives the ball over the net into the zoned areas to score points. The student tries to drive the ball as near the baseline as possible to obtain higher points.
5. Ten trials each are given, and the student chooses any ten balls to return on the forehand.

Note: It is important that the same instructor hit all balls to the students in order to standardize the procedure. (If a school possesses an automatic ball-throwing machine, this can be used most effectively.) The machine was not used in this study because the majority of schools teaching tennis do not own this expensive equipment.

Scoring the forehand drives--

1. A student records all scores in proper places on the score sheet for each of the ten forehand drives going over the net and under the restraining rope. These scores will be for the number zones marked on the lines for their respective spaces--5, 4, 3, 2, and 1.
2. Balls hit over the 7-ft. restraining rope and into the scoring zones score one-half the regular value.
3. Balls hitting into net label N (net) = 0 score.
4. Balls going over the baseline label 0 (out) = 0 score.
5. Balls going wide of sidelines label W (wide) = 0 score.
6. All let balls repeated.



COURTS MARKED FOR HEWITT'S TEST

EXHIBIT B

TEST INSTRUCTIONS FOR FOREHAND  
PERFORMANCE TEST

These instructions are read to all subjects before starting the test.

Pretest: "This is a forehand test. When your name is called, take your number and place it on the floor, back near the curtain, with the number facing the last window. Be sure you have your own number."

"This is the test: Take a position, just behind and in the center of the baseline. The ball machine will send balls to you. Let the ball bounce once and then hit it with your racket. Try to hit the ball over the net so that it lands somewhere inside the court on the other side." (Indicate double sideline and rear serving area.) "Do not let the ball bounce more than once. Do not hit the ball before it bounces once. Position yourself so that all balls come to your racket side. If you are right handed, this will be the racket side; vice versa, if you are left handed. You will receive five balls for practice and then two trials. The balls will not come fast.

"If the ball coming from the machine, or the ball which you hit, touches the rope above the net, it will not score, and you will receive another ball. Do not worry about the rope above the net. The machine will

stop at the end of your ten trials. Pick up your number and be seated. Please stay seated while you are not being tested.

"This test is not related to your status in the class. Do the best you can and relax.

"Are there any questions?"

Posttest: "This is the same forehand test which we had at the beginning of the term. Let me remind you, when your name is called, to place your number near the curtain so that it faces the last window.

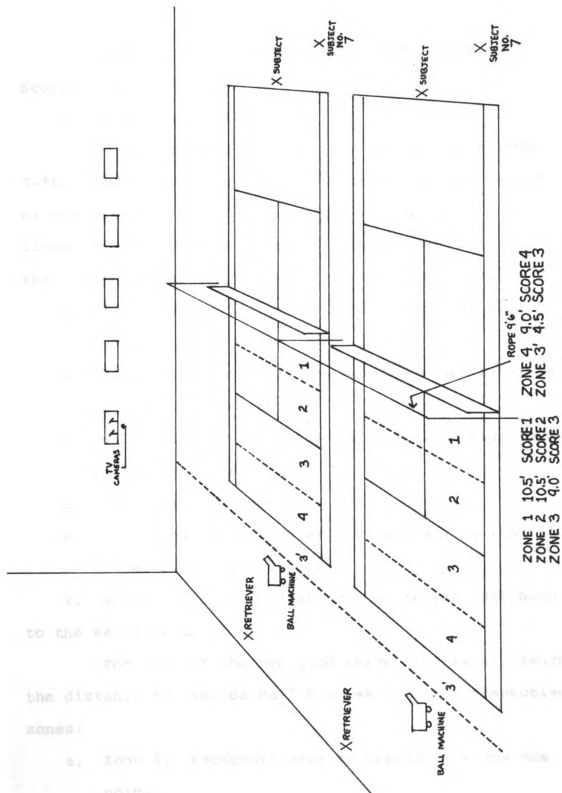
"You know that the TV camera is filming your stroke for data to rate your form. This is a test of performance and form, only on forehands. You will receive five practice strokes from balls tossed by the machine and then ten trials. Position yourself near the baseline and in the center of the court. When you are finished, please pick up your number and be seated.

"The scoring is determined by where the ball lands on the other side of the net. Notice that: Zone 1 receives 1 point; Zone 2 receives 2 points; Zone 3 receives 3 points; Zone 4 receives 4 points; and the Zone 3' behind the baseline receives 3 points. Any ball that goes between the rope and the net receives double the value of the zone in which it lands.

"Any ball that hits the rope will be repeated.

"Do you have any questions? Relax and do your best."





## FOREHAND PERFORMANCE TEST

## EXHIBIT C

## HEWITT'S TENNIS ACHIEVEMENT TEST: SERVICE

## Scoring the serve--

## 1. Placement of the serve

For every ball hit over the net and under the 7-ft. restraining line, the serve is scored on the basis of the target area hit. Since the numbers are on the lines, score all hits for their appropriate lines and their adjacent spaces to the right of each number.

- a. Score as 6, 5, 4, 3, 2, 1 placement for each of the balls served.
- b. Balls hitting out of the service court label as L (long) = 0 score.
- c. Balls served out of the service court wide label W (wide) = 0 score.
- d. Let balls are repeated.
- e. Served balls going over the restraining line label H (high) = 0 score.

2. Speed of serve or distance the served ball bounces to the second bounce.

For each of the ten good serve placements, score the distance the served ball bounces into the respective zones:

- a. Zone 1: Backcourt area to baseline--score one point.

- b. Zone 2: Area ten feet beyond the baseline--  
score two points.
- c. Zone 3: Area ten to twenty feet beyond the  
baseline--score three points.
- d. Zone 4: The area twenty feet beyond the baseline  
or the fence in most instances--score four points.

## EXHIBIT D

TEST INSTRUCTIONS FOR SERVICE  
PERFORMANCE TEST

These instructions are read to all subjects before starting the test.

Pretest: "This is a service test. When your name is called, take your number and place it on the floor, back near the curtain, with the number facing the last window. Be sure you have your own number.

"This is the test: Take a position behind the baseline and just to the right of the center mark."  
(Demonstrate.) "Take a ball, toss it into the air, and hit it before it bounces. You are trying to hit the ball over the net into this area, the service court. The ball must not touch the court on your side of the net." (Demonstrate service in both elementary and advanced style.)

"Underhand or sidearm deliveries are not allowed for this test. You will receive ten service trials for the test.

"The test will be scored as follows:

1. Serves that land in the service court will score 1.
2. An additional number of points will be added to the good serve for the second bounce--1 for Zone 1; 2 for Zone 2; and 3 for Zone 3.

3. A serve which touches the top of the net, but is otherwise good, will be repeated.

"The total possible point total is 40. When your trials are completed, pick up your number and be seated. Please stay seated but feel free to converse while you are not being tested.

"Do you have any questions?"

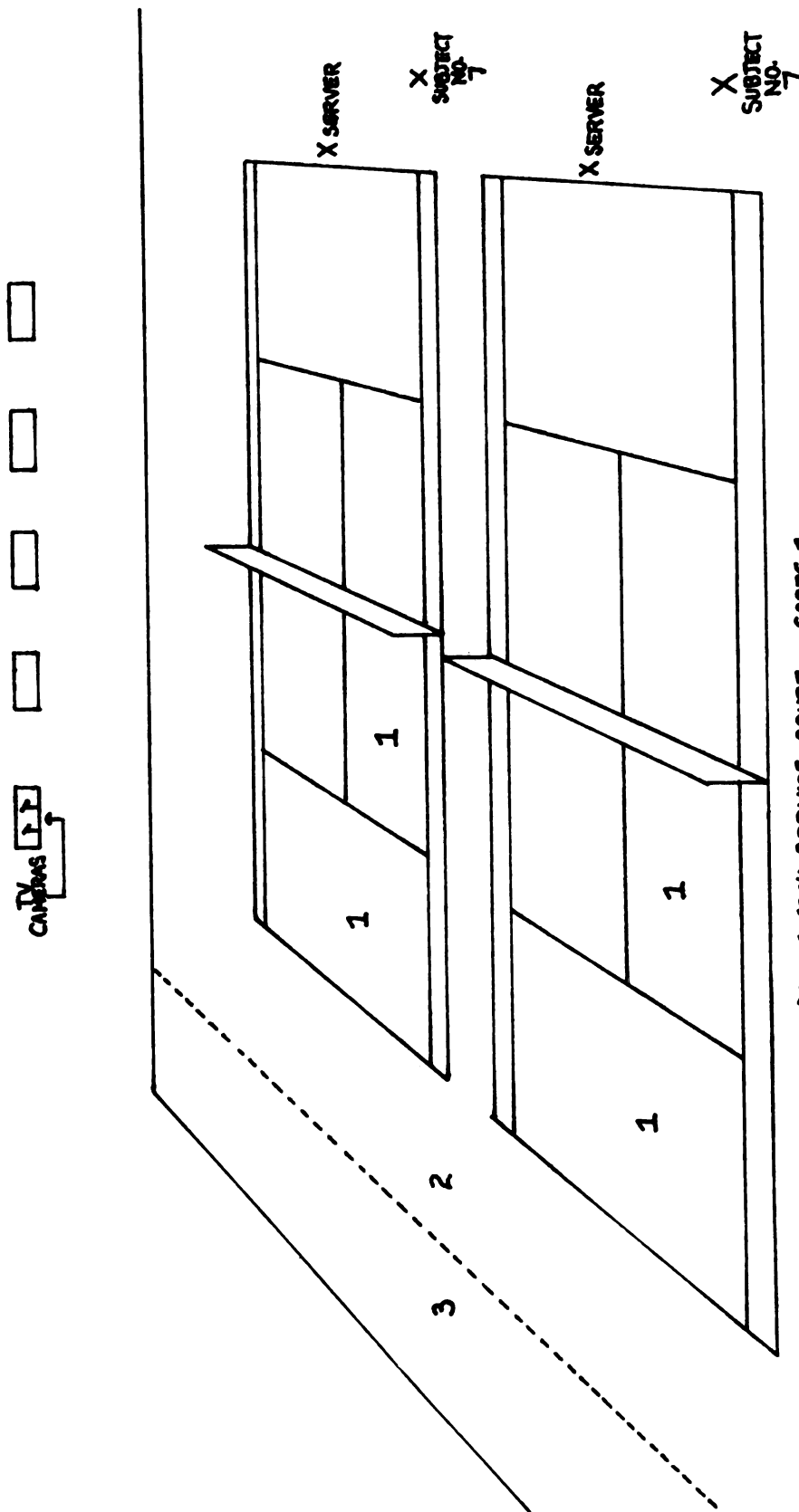
Posttest: "This is the same service test that we had at the beginning of the term. You have had your ten-minute warm-up. For the test, let me remind you to place your number near the curtain so that it faces the last window.

"You will again receive ten trials. The prerequisite for any score is to first get the ball into the service court. Additional points will be added according to the areas marked on the court and determined by the second bounce of the ball. Let serves will be repeated.

"You know that the TV camera is filming your stroke for data to rate your form. This is a test for form and performance.

"Do you have any questions?"

"Please pick up your number when your trials are completed and then be seated. Relax, and do your best."



**EXHIBIT E (1)**

# BEGINNING TENNIS FOREHAND--FOR PERFORMANCE

**Date** \_\_\_\_\_ **Class** \_\_\_\_\_

**SCORING:**    1 point    2 points    3 points    4 points    3 points

| FIRST<br>AREA | SECOND<br>AREA | 3RD<br>AREA | 4TH<br>AREA | BEYOND<br>BASELINE |
|---------------|----------------|-------------|-------------|--------------------|
|---------------|----------------|-------------|-------------|--------------------|

Circle score if ball goes between rope and top of net.

Balls which touch a line dividing two scoring areas count the value that is smaller.

**Circled scores count double.**

**REPEAT ANY BALL WHICH HITS THE ROPE**

**Each Subject--5 practice trials and 10 trials**

| Video<br>Tape<br>Number | NAME | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Total |
|-------------------------|------|---|---|---|---|---|---|---|---|---|----|-------|
|-------------------------|------|---|---|---|---|---|---|---|---|---|----|-------|

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## **APPENDIX B**

### **TRANSCRIPTIONS OF AUDIO TAPES**

## APPENDIX B

### TRANSCRIPTIONS OF AUDIO TAPES

#### EXHIBIT A

##### MPP TAPES (MENTAL PRACTICE POSITIVE)

##### A. BEGINNING TENNIS: FOREHAND, TAPE 1, MPP

This is the first in a series of tapes designed to help you learn the forehand stroke for tennis. In addition to the physical practice which you have in class, you may practice mentally.

First, you may rehearse the steps for good stroke production to become more familiar with them, and second, you can imagine yourself going through the motion of doing the forehand to get the "feel" of it.

Mental practice has been defined as the symbolic rehearsal of a physical activity in the absence of any gross muscular movements. It is used by experienced gymnasts, divers, skiers, etc. The question here is: Can it help beginners to learn a skill such as tennis? As you practice mentally, you should close your eyes and concentrate very hard. Attend closely to each step and then, gradually, as you become familiar with the steps, feel the entire stroke flowing very smoothly from

beginning to end. Do not actually make any (overt) movements. Try hard to feel that you are moving. Do not just listen to the information. Move in your mind . . . pretend . . . imagine.

This first tape will review the material from the first forehand lesson. Even if you think your skill is beyond this level, please listen and practice. All instruction is for right-handed players. The first of the two drills is without the ball. Therefore, watch your racket throughout the stroke to become familiar with its position.

Are you ready? Eyes closed. Now concentrate. Imagine that you are standing on the court with your racket in both hands, facing the net. There are three parts to the stroke: the ready position, the preparation (of racket and body), and then the stroke.

First, the ready position--facing the net. Your left hand is on the throat of the racket, holding the racket in front of you so that the racket head is pointing toward the net and the grip end is pointing toward you. The racket head is on edge so that you can see neither face of the racket.

Put your right hand in front of you, above the grip, as if to shake hands with someone. Without changing your hand position, place it on the grip. Close your fingers and thumb around the grip and "shake hands" with

it. The "V" between your forefinger and thumb should be apparent as you look down on your grip from above.

If you prefer, you may find the proper grip by placing the palm of your right hand against the strings on the right face and then, without turning your hand to right or left, slide it down onto the grip and again, close your fingers and thumb around the grip. Be sure your thumb is not on top as you look down on your grip. "Feel" the grip in your fingers. With the proper grip, your hand and racket will be on edge when stroking so that the strings are merely an extension of the palm of your hand, as if you were stroking with your hand.

(Pause.) Now, you have the proper grip and are facing the net with your racket in both hands (left hand at the throat) and racket head pointing towards the net. Place your feet about shoulder width apart; bend your knee so that your weight is forward over the balls of your feet. You now have a good "ready position."

Next comes the preparation part of the stroke--preparation of your body and racket to make the stroke.

(1) First, pivot on both feet to the right so that your feet are at about a 45° angle to the net and your left shoulder is pointing toward the net. At the same time

. . .

(2) Release your left hand from the racket; bring the racket straight back along a line parallel to the ground

and about waist level until the racket is pointing at the wall behind you. Follow the racket path with your eyes so that you can see and feel its position.

(3) Keep the racket on edge and keep your elbow fairly close to your body.

(4) Look at your racket. It should be on edge, pointing at the wall behind you, with the racket head not higher than your wrist.

The preparation is complete. Now for the stroke.

(1) First, step with your left foot toward the net, keeping your foot at about a 45° angle to the net. This will allow your knee to bend more as your weight shifts in the direction of the net as you stroke the ball.

(2) After you step, bring your racket forward. (Remember, we are doing this in slow motion.) After you step, bring your racket forward, keeping your eyes on the racket and keeping the racket on edge moving parallel to the floor until it is almost even with your left foot. Feel your weight shift to your left foot more and more as your racket moves forward.

(3) When the racket head is almost opposite or even with your left foot, start moving it upward and forward, keeping it on edge until

(4) the racket head is high and pointing toward the opposite wall. In this follow-through position, your right hand or racket hand will be out in front of and level with your left shoulder.

(5) Stop your stroke with the racket head high and pointing at the opposite wall.

At the end of your stroke, your weight will be almost entirely on your left foot, but both feet are still in contact with the floor. Even though both feet are in the same position as at the beginning of the forward motion of the racket into the stroke, your shoulders will have turned, and you are facing the net with the racket hand well in front of and level with your left shoulder and your racket head high, on edge, and pointing at the opposite wall.

Hold this position a moment, then step back with your left foot to the ready position, and ready for the next stroke.

(Pause.) All right, now relax from your ready position for a moment as we review some of the detail and then we'll stroke through without stopping.

A. Here are some check points for you to remember for the ready position.

1. First, always check your grip for the forehand. Remember that the racket is an extension of your arm. The racket face is an extension of the palm of the hand.

2. The left hand is on the racket throat and the racket head is pointing toward the net.

Get accustomed to the left hand going to the racket throat after every stroke as this hand will function

significantly later when you wish to change your grip for the backhand.

3. Your feet are about shoulder width apart, your knees are bent so that your weight is well over the balls of your feet. (This is very important.)

B. Check points on the preparation of the stroke.

1. First, you pivot on both feet until they are almost at a 45° angle with the net. (This is a fairly slight pivot.) As you pivot, release your left hand and bring your racket back along a line about waist level until it is pointing at the wall behind you. Remember, in this drill without the ball, watch your racket so that you may see and feel its position.

2. Keep the racket on edge and not higher than your wrist.

C. Check points on the stroke itself.

1. The first part of the stroke is to step toward the net with your left foot, keeping it at about a 45° angle to the net.

2. Start moving your racket forward, keeping it on edge and at the same time feel your weight shift steadily toward your left foot.

3. Move the racket parallel to the ground until it is almost even with your left foot and then start moving it upward as you continue moving it forward.

4. At the finish, your racket hand is level with and out in front of your left shoulder--well in front of your left shoulder. Your racket head is higher and still on edge, and your feet are both in contact with the floor as at the beginning of the stroke. Your upper body would be then facing the net. (Pause.)

Are you still with me? Don't go to sleep! Remember, there is no ball to stroke yet so watch your racket as you move it. Close your eyes now and concentrate and try to feel.

Now, let's practice in slow motion with just three cues. The cues from me will be: ready position, preparation, and step and stroke.

All right, here we go in slow motion. Ready position. Preparation. Step . . . and stroke . . . and hold your follow-through . . . and,

Back to ready position. Preparation. Step . . . and stroke . . . and hold your follow-through . . .

Back to ready position. Preparation. Step . . . and stroke . . . hold the follow-through . . . and stop.

As you do this in slow motion and you start with the ready position, run through all the check points in your mind on the ready position--feet shoulder width apart, proper grip, weight forward on the balls of your feet, and in order to have your weight forward on the balls of your feet, your knees will have to be well bent.



Run through the preparation--the pivot, 45° angle of your feet to the net, and the slow backswing of your racket--keeping it on edge, keeping it about parallel with the floor, keeping your racket head no higher than your wrist--and then step with your left foot, start your forward swing through with the racket, keeping it on edge. Watch your racket all this time because we have no balls to watch. Watch your racket and hold your follow-through and check to see if your right hand is well in front of your left shoulder and your racket head is high, and then stop.

During the one-minute pause on the tape, practice. Practice this in slow motion--if you still need to practice it in slow motion--but by all means, practice it up to normal speed until the steps flow from one to another into an uninterrupted, smooth, total stroke pattern. Ready? Begin.

(One minute pause)

All right, now you should have been able to practice several slow motion and several up-to-speed strokes in that pause and to get a feeling for it flowing smoothly from beginning to end without interruption.

The next and last drill on this tape will not take so long as we are only adding a self-toss of the ball to the stroke. So while you are relaxing, with your eyes open now, let's review the checkpoints on the self toss:

1. Your left hand is holding two balls in addition to holding the racket at the throat.

2. You're in your ready position. Always toss the ball up with an underhand toss to give yourself more time.

3. And the sequence for the self-toss drill is: Take your ready position, then take your preparation (with your racket back and your feet pivoted), then toss the ball, let it bounce, then step and stroke.

4. Another check point on this drill: toss the ball up so that it will rebound from the floor somewhere on a line in the direction your left foot is pointing after you have pivoted.

5. When you step with your left foot, step so that your left foot is even with the point at which the ball rebounded from the floor. In other words, if you draw a mental line between the point where the ball hit the floor and where your left foot is after your step, the line between the two should be parallel to the net. The line should be parallel to the net, not your foot. The line between your foot and the point at which the ball hit the floor on the bounce should be parallel to the net.

6. Unlike the drill without the ball, always watch the ball from now on. Always watch the ball and not the racket. You will be able to see the ball come off the strings if you are watching it as closely as you

should. This is terribly important. Watch and try to see the ball actually come off the strings.

All set? Close your eyes and let's do the whole thing in slow motion. Remember, concentrate hard and imagine a smooth stroke.

Ready position. Preparation . . . Toss. Let the ball bounce . . . step and stroke. Hold the end of the stroke and watch the ball.

Repeat this sequence for yourself, both in slow motion (if necessary) for you and up to normal speed in the next one-minute pause on the tape. Remember, you are going to take ready position, preparation, then the toss, let the ball bounce, step and stroke, and follow-through. Begin.

Thank you for your attention. This is the end of Tape 1 on the forehand.

## B. BEGINNING TENNIS: FOREHAND, TAPE 2, MPP

This mental practice session will consist of only one drill: the toss of the ball by a classmate to you as you practice your forehand.

All instructions again are for right-handed players. Remember, imagine you are moving. Imagine yourself playing superbly! Close your eyes. Do not make actual movements. Concentrate. Try to visualize and feel the stroke with the instructions on the tape.

There are two major variables in this drill to which your attention must be given: (1) the timing of your preparation for the stroke and (2) your adjustment to the ball traveling toward you. Let us first consider your stroke preparation.

You will recall that in the self-toss drill, you proceeded in this order:

- (1) the ready position
- (2) the preparation (namely, pivot and racket back)
- (3) you tossed the ball
- (4) you watched its contact point on the floor
- (5) you stepped to align your left foot with the ball
- (6) you stroked from low in behind the ball and ended up with racket high and pointing to the net

Your contact area with the ball was somewhere near a line with your left foot. To say "an area"

suggests that your strings have contact with the ball for more than an instant. This is true! By shifting your weight to your left foot as you stroke forward, you will keep the ball in contact with your strings longer. This will give you better accuracy and consistency.

By starting waist high and finishing higher than your shoulder, some top spin will be placed on the ball which will cause it to drop and stay in the court better than a ball with no spin. With this slight top spin, you can aim three to six feet higher than the net and still get a deep, backcourt stroke. Result: fewer netted balls and fewer long balls.

The important part of any stroke, once you have grooved the proper stroke, is your adjustment to the ball so that the ball is on a line with your left foot and about waist level at the moment your racket makes contact with the ball. If you align yourself correctly, and in adequate time, your stroke will always be essentially the same and will not have to be hurried.

If your stroke on the self toss is not consistent, perhaps you should listen to and practice the self-toss on the latter part of tape 1 again before listening to tape 2.

Now, to get to today's drill. The major difference between the self-toss and the toss by another person is in the directional flight of the ball. The stroke is the same.

In the self-toss, the ball is traveling up and down in a vertical plane. In other words, you know that the ball will rebound straight up from the point at which it contacted the floor. For this reason, you were instructed to wait for the ball to bounce and then place your left foot in line with the point from which the ball would rebound straight up. This gave you the proper alignment of the left foot to the ball for proper racket contact. You only needed to time your stroke so that you also contacted the ball when it was about waist level in its flight.

In the toss of the ball by another person, the adjustment and timing are somewhat different as the ball is not only traveling in a vertical plane but also in a horizontal plane coming toward you. Because it is traveling in a horizontal plane, you cannot wait for it to bounce and then place your left foot in line with that point. The ball would be past you before it reached waist level on the rebound. This is exactly what happens if the ball is traveling faster than you judge it is.

You must, therefore, anticipate where the ball is going to bounce and make your preparation for the stroke. You move up if it is short, back if it is deep, or make any sideways adjustment. If you wait until the ball bounces to move or to prepare for it, you will be late and rushed, getting a poor stroke at best. In other

words, you must make a judgment about the speed, loft, and distance of the ball flight as soon as it leaves the tosser's hand, or the ball machine, or the wall, or your opponent's racket. This judgment must be made in an instant. As you are making this judgment, you are preparing your racket by taking the backswing as you move to the area you have estimated to be correct in order to be properly aligned with the ball.

In the toss by a classmate--if the toss is good--you will need to move very little. But none of us can toss exactly to the same spot every time; therefore, you will have to make some adjustment.

Your sequence of response should be as follows:

1. Prepare your racket by taking the backswing as soon as the ball leaves the tosser's hand or the ball machine. Take your racket all the way to the wall immediately. Later, with more experience, your backswing will be timed with the speed of the ball. Watch the ball.

2. Make your initial judgment about the path of the ball, the loft, and the speed of the ball as you move to the proper alignment. Continue to watch the ball.

3. Make your last second adjustment of alignment as you see the ball rebound from the court and then step to align your left foot with the point at which you think it will be waist level. Watch the ball, and

4. Stroke, watch the ball leave the strings.

To simplify all of these variables, you will first want to prepare for your stroke (to prepare means that you pivot and take your backswing right away) so that once you have moved to the general area of contact, all that remains is your final judgment, step, and stroke. By doing this, you will leave your stroke unhurried and, therefore, more accurate.

All of the judgments about the ball flight and proper placement of the racket on the ball require that you focus closely on the ball from the time it leaves the tosser's hand until it leaves your racket.

You are not watching the ball closely enough if you do not see it come off your strings as you stroke.

Open your eyes now--blink twice--stretch--and then close your eyes again so that we can try all of this mentally.

Are you with me? All right. Place yourself on the court in the ready position facing the net.

Everything is slow motion including the ball.

1. The ball is leaving the tosser's hand. Watch it go up slowly and come down slowly.
2. As you're watching, turn and prepare your racket.
3. The ball hits the court and rebounds up while you have moved to a position just back of and to the side of where it will reach waist level.



4. It's coming to waist level; step with your left foot, even with where you think it will be at waist level, and

5. Stroke through as your weight shifts toward your left foot.

6. And finish racket high.

How did it go? Let's try again, in slow motion.

Ready position  
 Partner tosses  
 Track the ball in the air and prepare with pivot  
 and backswing  
 Move toward the ball  
 Stay behind and to the side of it  
 Watch it bounce and come up  
 Step before it reaches waist level  
 And stroke as it reaches waist level.  
 Watch the ball come off the strings.  
 Feel your weight shift forward and finish high.

Once more in slow motion--now try to stay with me. This time your cues will be shorter.

Ready position  
 Toss leaves tosser's hand  
 Track and prepare  
 Move and track  
 Step and track and stroke  
 Track and follow through

Now it's time for you to take several strokes during the pause on the tape. Take them in slow motion if you feel it's necessary, but, by all means, take many at normal speed.

Remember that the key to control is to prepare early, track the ball continuously, move to the ball quickly, and take your time on the stroke. Begin.

(Pause for one minute.)

I hope that went well. I hope you made some superb strokes and feel the smoothness of the stroke. Thank you for your attention. This is the end of tape 2 on the forehand.

### C. BEGINNING TENNIS: FOREHAND, TAPE 3, MPP

This is the last in a series of three tapes designed to help you mentally practice the forehand. On these tapes, we have reviewed material given in class and have given you some additional practice to help provide insight into the skill. The first two tapes covered the grip, ready position, stroke pattern, moving to the ball, and positioning for the stroke.

This tape will be concerned with ball tracking, or reading and reacting to various ball flights. Some of you are experienced in ball tracking sports; others are not. Even the experienced students need to learn to react appropriately in tennis by way of preparation and visual discipline.

Learning the stroke pattern was easy. The difficulties began when you tried to coordinate the stroke with the moving ball.

The self-toss was relatively easy as you had control over all variables within the range of your tossing and stroking abilities. When the toss of the ball by another player was added, the variables became more numerous. The better, more careful, and sympathetic the tosser, the easier it was to move into position for a good stroke.

The ball machine is a more consistent tosser, but even it is not without variation. Balls themselves--even new balls--have a slightly different response after a little use. Balls coming off the wall will vary in direct relation to the variance in your stroke which determines how fast, how high, and in what direction the ball comes off the wall.

Up to this point, we have tried to control as many of these variables as possible so that you could attend to the stroke pattern and concern yourself very little with having to move any appreciable amount to get to the ball. We will continue to try to control the variables in ball flight and bounce, but, ultimately, the fun in tennis is to play with and against a friendly opponent. In the latter situation, your opponent will send many varieties of ball flights to you, both by accident and intent. You need to become prepared to anticipate and adjust to all kinds of ball flights (and opponents, although we'll not concern ourselves with that).

From now on, when we are working on the forehand in class, you will have the opportunity to practice with the ball machine part of the time and with a tosser sending balls to you from the other side of the net part of the time. All of this is to help you groove your stroke. However, you will be required to be alert and anticipate a variety of ball flights coming to you.

What we have emphasized up to this point--the alert ready position with knees well bent, the preparation (that is, moving to the ball with your racket back and turning)--should be well on the way to becoming automatic for you. If this is true, if your ready position--your good ready position with knees well bent and your automatic preparation--are really a part of you at this point, then you can give all your attention to tracking, interpreting, and adjusting to the ball flight. If you learn to position yourself in this way, and track the ball into and out of your strings, your stroke will be good an increasing number of times. Remember that the loft on the ball before it bounces will give you a clue to the height of its rebound. The higher the loft, the higher the rebound. The lower the loft, the lower the rebound and the less time you have.

So--let's practice! Close your eyes and visualize.

This is slow motion for now.

Place yourself on the court just back of the baseline--2 or 3 feet back of the baseline. Take your ready position. Here comes a high ball (at least 20 feet above the net). It's moving very slowly. It looks as if it will land in the backcourt near the baseline. So, move back a few steps as you bring your racket back and get your left shoulder to the net. It's coming . . . it hits the court and rebounds much higher than your reach, but

. . . it starts to drop. . . . Now you know where to take your final step with your left foot. Watch the ball come off the strings. Follow through. Watch the ball go deep into the other backcourt. A superb stroke if I do say so myself! Yes, that's what's fun about mental practice. . . . You can make yourself just as good as you can imagine!

Ready position again . . . hang in there. Here comes another high ball, but this one looks as if it will bounce somewhere near the service line instead of deep. Move up a little as you bring your racket back. Turn your left shoulder to the net. Watch the ball bounce and go up. Now you know where to take your final step with your left foot. Watch the ball . . . step . . . stroke and watch the ball come into and go out of the strings as you shift your weight into the stroke. Follow through . . . and watch another good deep shot!

This is easy! No matter how high it bounces--if you're ready--watching and waiting and moving, the stroke is the same.

Now, during the next pause, practice each of these two high bouncing strokes up to normal speed--the high deep ball which forces you back so that you can turn and step into the stroke with your weight, and the short high bounce which forces you to move up, turn, and stroke. Go ahead and try it!

(Pause one minute.)

All right, let's try something different--still in slow motion.

Ready position. (Be sure your knees are well bent and your weight is forward over the balls of your feet.) Here comes a ball traveling low over the net (not more than three feet above it), and it's fairly well paced. It looks as if you won't have to move up or back much, but, prepare. Turn and get your racket back. Move your feet in small steps. Watch the ball bounce. It will rebound at about the same angle as it is coming into the bounce. Stay back and stay alert. Keep your feet ready. The ball comes up above waist level a little . . . now you can step and wait for it to drop below its peak to your waist level. Step . . . watch it . . . stroke. It comes into your strings . . . you see it move off your strings as you shift your weight forward and follow through. Another good stroke!

Ready position! Here comes another low ball, but it will drop inside the service line. Run up . . . turn your left shoulder to the net and get your racket back . . . watch the ball. It will not bounce very high--not as high as your waist. So, get your knees bent more, get low. Step . . . watch the ball . . . stroke. Watch the ball go into the strings and come out. Follow through. Terrific!

Once again, during the next pause, try stroking both of these ball flights--the low, deep, well-paced ball, and the low, short ball. Do this again in slow motion if necessary, but be sure to do several up to normal speed. On the deep ball traveling low, prepare early or it will get behind you. Go ahead and try several. (Pause one minute.)

We won't concern ourselves with various spins on the ball and what they do to rebounds. That will come later in your tennis development.

Other flight variations will be from side to side. The principle is the same. Track your ball carefully with your eyes, watch the loft and speed to give you a cue to the rebound and height and distance, but remember--always, always--prepare your racket and your positioning right away, as soon as you see the ball coming.

The speed of the ball is something which you will have to adjust to in terms of anticipation. However, if you get your racket back right away, you will only have to learn to adjust the timing of your forward swing of the racket. For instance, the faster the ball is coming--as you experience faster balls coming toward you--you will have to change your timing somewhat on when to begin the forward swing. You can spend the next two minutes practicing and adjusting to the various ball flights given--the high deep, high short, low deep, low



short, and various speeds of those flights, and remember that the speed of the ball--the increased speed of the ball--will simply mean a change in timing. You won't be able to adjust to that immediately, but it will come very quickly. Begin, and take one and a half minutes to practice on these ball flights.

(Pause.)

Thank you for your attention. This is the end of Tape 3 on the forehand.

## D. BEGINNING TENNIS: SERVICE, TAPE 1, MPP

The service is different from all other tennis techniques in that you, the player, have complete control over all the variables related to the skill. Wind and sun are the only uncontrollable factors to which a player must adjust, and for indoor play, even these do not exist. You control the placement of the ball and the placement of the racket on the ball. With this in mind, given the motivation and opportunity for practice, you should be able to develop a reliable service.

As mentioned in class, the primary purpose of the service is to put the ball into play to start the point. The secondary purpose is to place the ball into the service court in such a way that your opponent cannot return the ball for an outright winner.

The service has two essential parts: the placement of the ball and the swing of the racket to meet the ball. We will practice these two parts separately, first concentrating on the ball placement. All instructions are for right-handed players.

Close your eyes and imagine yourself behind the baseline, facing the curtain. Your left foot is at a 45° angle to the baseline and your right foot is comfortably back. You have no racket in your hand. Take a ball in your left hand and cradle it gently on slightly

bent, almost relaxed fingers, securing it with your thumb slightly. Stand with your weight mostly on your back foot (your right foot). Hold the ball about waist level directly above your left foot.

To place the ball, bring your left hand down toward the front of your left thigh and then push it straight up until your arm is fully extended, up over your left foot. Release the ball as late as possible. The palm of your left hand is facing up as if you were holding a glass of water on it. The ball should go about as high as your racket reaches or slightly higher. Then, let it drop back into your hand. Let's try that much again.

Stand with your left foot at a 45° angle to the baseline, and you're facing the curtain rather than the court right at the moment. Cradle the ball in your left hand so that it rests out toward the end of your fingers and your thumb is resting lightly on top of it. To place the ball, bring your left hand down toward the front of your left thigh and then push it straight up until your arm is fully extended up over your left foot. As you extend, you release the ball, trying to hold onto the ball just as late as possible. At the finish, your arm is fully extended and the palm of your left hand is facing up as if you were holding a glass of water or a glass of liquid on it. And then, let the ball drop back into your hand.

You will recall that you want to place the ball at such a height that your racket will make contact with it just at the point at which the ball reaches its peak and just before it starts to come down. In other words, you want to try to contact the ball with your racket when the ball is momentarily motionless. Placing the ball consistently in the right place, at the right height, requires considerable practice. Let's try the toss again, in slow motion.

Place yourself behind the baseline, left foot at a 45° angle to the line and your right foot comfortably back. You have no racket.

Take a ball and cradle it gently in your left hand, out toward the end of your fingers and secure it lightly with your thumb. Hold the ball about waist level above your left foot.

Bring your left hand down now, toward the front of your left thigh, and then up, straight up over your left foot to a full extension upwards. Just before you reach full extension, release the ball so that it goes into the air straight up over your left foot about 18 inches or so above your outstretched hand. Keep the palm of your hand facing upward toward the ceiling, as if holding a glass of water on it. Watch the ball carefully and let it drop back into your hand and repeat.

Down . . . up . . . release . . . reach. And then catch the ball. In the next pause on the tape, would you practice your toss in slow motion. You have one minute.

(Pause one minute.)

All right, that's very good. Now let's take the swing pattern of the racket and coordinate it with the ball placement. However, for now, we will not actually toss the ball. Simply go through the tossing motion without a ball.

For the beginner's serve, we will use a forehand grip.

Place yourself at the baseline as before for the ball toss. Pretend you have a ball in your left hand. Now try to imagine this. Hold your racket in both hands so that the head of the racket is pointing toward the curtain. Your left hand is holding the racket at the throat, and as for the ball toss, your left hand is also above your left foot and about waist level.

In other words, your left hand is holding the ball (which we won't use now) and also holding the throat of the racket, or pressing the ball against the strings of the racket. Your weight is on your back (or your right) foot. Both hands will begin together.

Now, in slow motion . . . very slowly. As your left hand comes down toward the front of your left thigh,

your racket comes down past your right knee. As your left hand comes up to full extension, your racket continues past your right knee and comes up in back of you to point at the wall behind you.

As the ball goes into the air and your left hand is reaching up, your racket head comes into your back and then your racket arm reaches up, fully extended, and forward to meet the ball in front of and above your right shoulder. Your racket meets the ball with the face flat and pointing in the direction you want the ball to go and continues on through to finish on your left side.

Your sequence of the racket swing from the beginning to the end is:

Knee--wall--back--ball

In other words, having started by pointing the racket head at the curtain, your racket head moves to these check points: knee (right knee), wall, to the back, and to the ball. The coordination of the ball placement hand and the racket hand is this:

1. The racket hand goes to the knee as the left hand goes to the thigh.
2. The racket hand goes to the wall as the left hand goes up.
3. The racket hand goes to the back as the left hand reaches up.

4. The racket hand goes to the ball as the left hand falls away. (You forget about your left hand at that point.)

Now, in slow motion again, so that you can see and feel the continuous racket action and the coordination of both arms and hand, try several serving motions using both hands but no ball. Say to yourself: "Knee--wall--back--ball."

As the left hand goes down, the right hand goes down. As the left hand goes up, the right hand goes up. As the left hand reaches, the right hand comes into the back and then up to the ball and through to the left side. Try it several times during the next pause on the tape. (Pause.)

We're going to do this again in slow motion, but here are some points for you to remember. Start with your weight on the back foot. That back foot should be back enough so that you can shift your weight from it to the forward foot or, rather, in the direction of your serve as you come through with your racket. Your racket starts in both hands, pointing at the curtain. When you toss the ball, watch the ball and try to meet the ball while it is "standing still." Point the face of the racket in the direction of the serve and follow through. Take several serves during the next pause and concentrate

on a continuous racket swing from start to finish. You should be trying this in slow motion and up to normal speed.

If you think you have the feel of it and have it coordinated in slow motion, then move up to normal speed and take several practice swings during the next pause on the tape.

(Pause.)

Be sure to watch the ball. Watch it come off the racket. Don't go to sleep. Try to get a smooth, flowing, fully coordinated serve.

You can practice this any time. Go through it mentally and see if you can get it coordinated and worked out. This is the end of Tape 1 on the service. Thank you for your attention.



## E. BEGINNING TENNIS: SERVICE, TAPE 2, MPP

On the first tape, we practiced as we had in class, standing behind the baseline and facing the curtain. We worked on getting a consistent ball placement and then on coordinating the toss and the swing of the racket so that the swing would be continuous and the racket would meet the ball when the ball was "standing still."

On this tape, we will start on the other side of the baseline, facing the net. We will continue to work for good ball placement and a continuous full swing but also work toward putting the ball into the service court. Close your eyes and position yourself just to the right or left of the center mark on the baseline. If you are to the right of the mark, you will be aiming into the right service court, and if you are to the left of the mark, you will aim into the left service court. You will recall that the left foot is at a 45° angle to the baseline and your right foot is comfortably back.

We need to be more specific on this now. Place your right foot or back foot so that if you draw an imaginary line between the toes of your feet, the line will point toward the court into which you intend to serve. Also, place your right foot far enough away from the left to get good weight shift into the serve.

It is terribly important that you line yourself up properly for each service court. Your left foot will

always be pointing toward the right net post regardless of which court you're serving into. Draw that imaginary line between your toes as you line up for the serve and see if the line is pointing toward the court into which you plan to serve. Do not rush into your serve without lining yourself up properly or without looking at the area into which you intend to serve. Let's do this in slow motion.

Take your position at the baseline. Hold your racket and ball in both hands--racket pointing toward the net with weight back. Start the motion with both hands slowly. Down with both hands, up with both hands. Release the ball and watch it. Reach with left hand (palm up) and into the back with the racket. As your racket goes down your back, bend your back knee some, then reach for the ball. Meet it right on the "nose" with your racket face pointing toward the service court and racket arm fully extended. Finish through on your left side.

Very Good.

As you reach up for the ball with your racket, you should push up with your back foot. Get full extension as you meet the ball and shift your weight into the serve.

As your racket face meets the ball "on the nose," your wrist should flex forward on the follow through.

This will help bring the ball down into the service court after it crosses the net. You should be thinking "out and down" as you make contact with the ball. Do not stop your follow through in order to gain accuracy as this will result in a weak and "pushy" serve.

Keep your shoulder, elbow, and wrist quite flexible on the serve. Get full range of movement in each joint. You may, if you have a good overhand throwing motion, simply think of the serve as placing the ball up in front of your right shoulder, slightly higher than your reach and then "throwing" your racket at it. If you draw an imaginary face on the back of the ball, your racket contact is on the "nose."

The speed of your serve is, of course, determined by the speed of the racket head. That is the reason for the long preparation of the racket prior to ball contact. This motion allows you to build up speed in the racket head. Remember, however, that speed which sacrifices accuracy is pointless. Practice the full service, a free swinging motion of the racket, well timed with the toss, with good weight shift, and you will realize a consistent, well-paced serve.

At normal speed, I would like you to practice twenty serves into the right service court and twenty serves into the left service court. Be careful to place your feet in proper alignment for each service court.

Take your time before each serve. Get a full range of motion and a weight shift.

Close your eyes now and visualize yourself serving these serves. I'll give you four minutes.

(Pause for four minutes.)

Let me interrupt for just a moment. You are about halfway through with your practice time. Since you have control over all the variables on the serve, you can learn a great deal by experimenting. Try to keep your serves deep into the service court. Try aiming for the outside of the service court and then try aiming for the inside of the service court. Remember that you have two chances or two balls on each serve to get the point into play. You should learn from your first serve if the first serve does not go in, and then make your adjustment on the second serve accordingly.

If you are having difficulty getting speed on the ball, remember that the speed of the racket head controls that, and the weight shift controls it somewhat. So simply swing your racket head through faster. Shift your weight all the way through the stroke. Some of you may even end up crossing the baseline at the end of your serve, which is legal after you've made ball contact.

Keep testing yourself. Keep trying to go deep in the service court or to the outside, or to the inside.

This is the end of Tape 2 on the service. The more you serve, the better it will feel. See if the practice in your head helps as long as you can't get onto the court for any length of time to practice your serve.

Thank you for your attention.

## F. BEGINNING TENNIS: SERVICE, TAPE 3, MPP

On the previous two tapes, we have worked on the beginner's serve which would give you a full serving motion with which to start the point in a game. This serving motion is essentially the same for all serves regardless of how advanced you may become. There are differences, however, which result in different types of serves.

On this tape, I should like to give you the details on executing a simple spin serve. This serve should be of interest to those of you who can consistently control your serve--say you are able to get six or seven out of ten consistently into either service court. Then you should be ready to experiment with and learn a simple spin serve. I would suggest you do not practice this unless your other serve is reliable.

There are only two differences between this serve and the one you have already learned. The two differences are the grip and the action of the racket on the ball.

Instead of using the forehand grip, you will turn the racket clockwise, so that the knuckle at the base of your forefinger is almost on the top of the grip where the V was before on the forehand. When we get to the backhand, we will turn the racket clockwise so that the knuckle is on the top plate of the grip

where the V was on the forehand. On this service grip, the knuckle is not quite that far on top but sort of halfway between being on top and being around in back where it is on the forehand.

This grip will cause the racket face to meet the ball at a slight angle rather than straight in behind. As you meet the ball on the nose (that is, the imaginary nose on the face of the ball) and flex your wrist, the racket strings will scoot up off the nose and over the "left eye" on the face of the ball. This will give the ball some side-top spin.

Take care not to meet the ball on the nose and go off over the left ear as this will give you too much side spin. Your toss is the same and the swing is the same.

Let's try it in slow motion.

Position your feet at the baseline. Hold the racket in both hands, pointing toward the net. Look at the service court. Put your weight on the back foot. Now, start both hands down . . . then up. Release the ball and watch it. Reach with the left hand and bring the racket to your back. Now go up to meet the ball with your racket. Place the strings on the nose of the ball and slide up over the left eye and follow through to the left side of your body.

You probably noticed that your serve did not feel as solid nor did the ball go as fast as on your





previous serve. This is as it should be. Any time you create spin on a ball, you are meeting the ball a glancing blow, so to speak. You should be meeting the ball on the nose as your racket is traveling upward on your arm extension. As the arm continues to extend fully, the strings go up and over the top right side of the ball.

Visualize your racket arm coming up from the back position, up and over your shoulder. Just before you reach full extension of the arm, your racket strings make contact on the nose and then your arm continues to extend so that your racket strings are traveling up and over the top right side of the ball, up over the left eye of the face.

As a result of this, the ball will rise as it comes off the strings and then begin to drop from the spin. You are aiming up and out, and the ball should clear the net higher than on your previous serve. Since the ball is spinning left somewhat, you will have to aim more to the right side of the service court into which you wish to place the ball.

Let's try it again in slow motion.

Position your feet . . . racket and ball hand ready . . . weight back. Down with both hands . . . up with both hands . . . release the ball and watch the ball . . . racket to the back. Go up for the ball.

(Momentarily take your eyes off the ball and notice the angle of your racket.) Meet the ball as you are reaching up. Continue up and over the top right side of the ball. The ball takes off slightly upward, sails over the net, and bounces deep. As it hits the court it jumps slightly to the left and up. Good serve!

A good serve has pace, spin, and placement. During the next few minutes of pause on the tape, I would like you to try twenty serves into each court--up to normal speed if you are ready, in slow motion if you'd rather. But certainly try some up to normal speed. Think it through and make it work.

(Pause for two minutes.)

By way of review--what we've been doing on this tape is a different kind of serve, the simple spin serve. It spins as a result of your having shifted the grip on your racket--shifted from a forehand grip to a grip that goes in the direction of the backhand, which is between the backhand and the forehand grip.

The other difference in the serve, in addition to the grip on the racket, is the fact that the racket strings make contact on the nose of the ball before your arm is fully extended. Therefore, your racket is moving up the back of the ball, so to speak, and over the top right side which gives the ball side and top spin.

Any good serve should have some spin on it--and good placement and good pace. There is, of course, the cannon ball serve which is flat and has no spin. It is sometimes used as a surprise and as an opportunity to put the ball into the court so that your opponent cannot return it at all. It goes so fast that he just simply can't return it. That is a serve that is used, although not frequently, because the control on it is less than on spin serves. So, this is another serve, a simple spin serve. If your first serve (the flat straight serve we did first) is fairly reliable, you should start working on this serve and try to perfect it and make it consistent.

Don't underestimate your mental practice. Take it with you. That ought to do it for today. This is the end of Tape 3 on the serve. Thank you for your attention.

EXHIBIT B  
MPEIEE TAPES (MENTAL PRACTICE, ERROR INFORMATION,  
EXPERIENCE, ELIMINATION)

A. BEGINNING TENNIS: FOREHAND, TAPE 1, MPEIEE

This is the first in a series of tapes designed to help you learn the forehand stroke for tennis.

Mental practice has been defined as the symbolic rehearsal of a physical activity in the absence of any gross muscular movements. It is used by experienced gymnasts, divers, skiers, and others to rehearse just prior to performing. The question is: Can it help beginners learn a skill such as tennis? In addition to the physical practice which you have in class, you may practice mentally, or by imagining yourself performing the stroke. We are going to go through the material presented in the first lesson, recall the correct procedure, identify and experience some of the errors which normally occur, and then correct those errors.

If you are aware of causes of common errors and what kinds of errors you are making, then you should be more knowledgeable in self-correcting those errors. This does not mean that you will be left alone in class to figure everything out for yourself. It does mean that you will have the understanding to correct some errors that you may experience while you are learning.

On the stroke pattern without the ball, you will recall that there were three basic steps: the ready position, preparation (that is, preparing your body and your racket to make the stroke), and then the actual stroke. To practice mentally, you should close your eyes and concentrate by mentally following the procedure. Do not make any actual movements. Move only in your mind. Try hard to feel that you are moving. Do not just listen to the information, but pretend, imagine. All instructions are for right-handed players. When practicing without the ball, follow your racket with your eyes to become more familiar with its position.

Are you ready? Eyes closed? Now concentrate.

First, the ready position. Place yourself on the court, racket in both hands, facing the net. Your left hand is on the throat of the racket, holding the racket in front of you so that the racket head is pointing toward the net and the grip end is pointing toward you. The racket head is on edge so that you can see neither face. Put your right hand in front of you above the grip as if to shake hands with someone. Without changing your hand position, place it on the grip and "shake hands" with it. The V between your forefinger and thumb should be apparent to you as you look down on your grip from above. Do you see it? Be sure your thumb is not on top as you look down at your grip. With the proper grip, your hand and racket

will be on edge when stroking so that the strings are merely an extension of the palm of your hand, as if you were stroking with your hand.

Now, you have the proper grip and are facing the net with your racket in both hands (left hand at the throat) and racket head pointing toward the net. Place your feet about shoulder width apart. Bend your knees so that your weight is forward over the balls of your feet. Now you have a good ready position.

Next comes the preparation part of the stroke.

First, pivot on both feet to the right so that your feet are at about a 45° angle to the net, and your left shoulder is pointing toward the net. And, at the same time release your left hand from the racket. Bring the racket straight back along a line parallel to the ground and about waist level until your racket is pointing at the wall behind you. Follow the racket path with your eyes so that you can see and feel its position. Keep the racket on edge and keep your elbow fairly close to your body. Look at your racket. It should be on edge with the racket head no higher than your wrist.

The preparation is now complete, ready for the stroke.

1. Step with your left foot toward the net, keeping your foot at about a 45° angle to the net. This will allow your knee to bend and your weight to shift in the direction that you intend to stroke the ball.

2. After you step, bring your racket forward.

(Remember we are doing this in slow motion.) Keep your eyes on the racket and keep the racket on edge, moving parallel to the ground, until it is almost even with your left foot. Feel your weight shift to your left foot more and more as your racket moves forward.

3. When the racket head is almost opposite, or even, with your left foot, start moving it upward and forward, keeping it on edge, until . . .

4. The racket head is high and pointing toward the opposite wall. In this follow-through position, your right hand or racket hand will be out in front of and level with your left shoulder, and your racket head will be higher than your hand.

5. Stop your stroke with the racket head high and pointing at the net, or at the opposite wall.

At the end of your stroke, your weight will be almost entirely on your left foot, but both feet are still in contact with the floor. Even though both feet are in the same position as at the beginning of the forward motion of the racket into the stroke, your shoulders have turned and you are facing the net with the racket hand well in front of and level with your left shoulder and your racket head high, on edge, and pointing at the opposite wall.

Ready position . . . preparation (that's the pivot and racket back) . . . step . . . and stroke.

Stop now and open your eyes. The most common error at this point is not bending the knees enough.

Let's try a stroke now with stiff knees. Ready? Eyes closed?

Ready position with straight legs, no kneebend. Now we're practicing an error, so no kneebend. Preparation . . . step (Keep your knees straight, don't let them bend.) . . . stroke . . . and hold.

Can you shift your weight into the stroke with straight legs? No, you cannot! As a matter of fact, you cannot even pivot without bending your knees.

Now, in slow motion, do the correct stroke with me and bend your knees more than you have before. Ready position (knees well bent, body low) . . . preparation . . . step and stroke and hold the follow through. That should have felt easy and your weight shift should have felt better.

Now open your eyes again but listen carefully. Only one other error is necessary to experience and correct at this point, and that is the position of your racket face as it meets the ball and as it leaves the ball. Right, we have no ball now. That's why you can try different racket paths on your stroke and watch the difference in the position of the racket face in the area where you would be stroking the ball.



Close your eyes. Ready position.

Slow motion: preparation (and on this preparation bring your racket back very high and look at your racket) . . . then step and stroke down from up high and follow through high. Watch your racket and see if you know what position the face is in as it comes to the area for ball contact. You probably made contact underneath the ball rather than behind the ball. The face of your racket was open or slanted toward the ceiling as you made contact with the ball. You may also vary the position of the racket face as it meets the ball if you do not grip your racket firmly, but we'll deal with that when you have the ball to stroke.

Take a quick breather. Open your eyes. We're almost finished.

All we're going to do now is add the ball toss. You toss the ball to yourself. First, with your eyes open, let's review the check points for the self-toss.

1. Your left hand is holding two balls in addition to holding the throat of the racket.

2. Always toss underhand to give yourself more time.

3. For practice it will be easier if you follow this particular sequence: ready position . . . preparation . . . toss ball . . . let the ball bounce, step and stroke and follow through.

4. Toss the ball so that it will strike the ground somewhere on a line in the direction your left foot is pointing after you have pivoted.

5. Step with your left foot so that it is even with the point at which the ball struck the ground. A mental line between your left foot and the point where the ball hits the ground would be almost parallel to the net. Your foot wouldn't be parallel to the net but the mental line between your foot and the ball--where the ball hit the floor--would be parallel to the net.

6. Always watch the ball, not your racket. You should see the ball come off the racket strings. You should see it come into the strings and come off the strings.

All set? Slow motion! Close your eyes and concentrate. We'll do the complete stroke. Ready position . . . preparation . . . toss . . . bounce . . . step and stroke and hold. Step back with your left foot to the ready position and repeat up to tempo. Ready position . . . preparation . . . toss . . . bounce . . . step and stroke and hold the follow through.

All right. Open your eyes again and relax.

There is really only one error here in this particular drill provided your stroking pattern is good. Your stroke will be consistent as long as you place yourself properly in relation to the ball so that you

meet the ball at about waist level and about even with your left foot each time. Let's see what happens with two poor positions which are common. In slow motion--

First, toss the ball so far ahead that you have to reach ahead of your left foot to make contact.

Ready position . . . preparation . . . toss (too far ahead) . . . step . . . stroke (or try to stroke).

You're right. The racket made contact underneath the ball, if at all, and the ball went high. Now, toss the ball so that you step ahead of it. In other words, the ball is back of your left foot as you make contact.

Ready position . . . preparation . . . toss and step ahead of the ball and stroke. This time the ball probably did not go over the net, as you did not have your weight behind it.

It is useless to try to mentally practice with a loose grip as this fault results in so many varieties of ball flight. You'll never be sure where the ball is going as the racket face position presented to the ball will vary so much if your wrist is loose. Just remember to keep a firm (not tight) grip.

For the next minute, try several strokes at normal speed with the self-toss and feel the smoothness of the stroke from beginning to end. Try the correct stroke. Ready, begin . . .

(Pause.)

Thank you for your attention.

## B. BEGINNING TENNIS: FOREHAND, TAPE 2, MPEIEE

During the second lesson on the forehand, all of the instruction and practice was in trying to position yourself correctly to stroke forehands when the ball was tossed to you by a partner or by the machine. There were two major variables in that drill: (1) the timing of your preparation for the stroke, and (2) your adjustment to the ball traveling toward you.

Let's take the errors associated with the first variable--that of timing and preparation for the stroke.

If you start your preparation too late, say as late as when the ball bounces, it could cause you to stroke late. If you contact the ball considerably back of your left foot alignment, your racket face will, at this point in the forward swing, be aimed to the right and your shot may go to the right. Let's try to visualize that in slow motion.

Close your eyes and concentrate on the ball coming in slow motion and all of your movements in slow motion. Ready position. The ball is coming toward you, slowly. (Don't take your back swing or turn yet.) The ball continues to come. Don't prepare . . . here it comes . . . there, it hits the floor. And, after it hits the floor, take your racket back slowly as the ball bounces past your left foot alignment. Now start your stroke. Just as the ball is opposite your right foot, your racket makes

contact. Look at the position of your racket face as the ball meets it. It's slanted toward the right . . . and there goes the ball . . . and it goes to the right.

Not only does your ball go to the right, but your weight is not forward over your left foot yet, and your stroke is weak. In addition to all that, it didn't feel very good.

The same effect on the ball can occur if you take a backswing that is too long. You may meet the ball late, simply by swinging back too far, and then not be able to get your racket around and through. Just mentally do that once, without a ball, and watch your racket position as you swing through. Take your ready position now, and let's not involve any ball in this. Bring your racket back, and turn. Then start swinging through slowly on your stroke. Look at the position that the racket face is in as it gets opposite your right foot. It will be slanted so that the racket face is pointing toward the right, and that will cause you to hit to the right.

Another effect of waiting too long to prepare your body and racket is that it rushes your stroke. You may instinctively speed up your backswing and stroke by starting late, in which case you have little control over accuracy. If you wait too long and compensate for having waited too long by swinging your racket back faster and

swinging it forward faster, then you will have less control, and the result will be less accuracy on your stroke.

Let's try another late preparation in slow motion. Stay with me now.

Ready position. Here comes the ball from the tosser's hand. It's in slow motion, but so are you. Don't prepare. The ball bounces and you realize you have started late, so hurry your backswing and stroke. Well, you may have hit the ball, but you didn't stroke the ball, and there's a difference. A hit on the ball means just one instant of contact of the strings with the ball. In tennis you need to stroke the ball through an area which is nearly opposite your left foot, in that general area. The ball will literally move across your strings if you are stroking, as opposed to bounding off the strings immediately after contact if you hit. --You didn't have time to step into it, and therefore you didn't keep it on your strings long enough to stroke or aim. This is a primary difference between stroking a tennis ball and hitting a ball with a baseball bat or hitting a hockey ball. In those two situations you have an instantaneous, one momentary contact of the implement with the ball. In tennis, your ball stays on the strings for a while, relatively speaking.

You see, a late preparation of your racket not only upsets the contact with the ball in different ways

but also gives you too much to do all at once, and you cannot get your weight shifted into the direction of the ball flight as it leaves your racket. So, as a result of that, what you should remember from that experience is that you want to prepare your racket right away and don't take too long a backswing.

Now, so that you don't forget the correct way, take several slow motion strokes, and several strokes up to normal speed in the next pause on the tape. Remember to get a good ready position with your weight forward over the balls of your feet, your knees well bent. Start your preparation as soon as the ball leaves the tosser's hand or the ball machine, watch the ball carefully and judge where it will rebound to waist level while you are preparing and moving into position, contact it near waist level and in an area near your left foot alignment, watch it come into and go out of your strings, and follow through. Go ahead and stroke some. I'll be back in a minute.

(Pause.)

Now, when you're practicing mentally a drill such as that, continue to force yourself to use your imagination and feel the activity--feel everything that should be associated with the skill.

Now let's take some errors that are associated with poor adjustment to the ball. We've talked about

errors associated with waiting too long to prepare your racket. Let's talk about what happens when you don't adjust correctly to the ball. Some of you have had more experience with games requiring adjustments to moving objects or moving balls than other people in the class. However, even those of you with considerable ball game experience need to apply that experience specifically to tennis.

First, let's take a misjudgment on depth. This is similar to the errors we practiced on the self-toss. Take your ready position . . . slow motion. Here comes the ball and it's going to drop short. You don't recognize this so you don't move up. But you do prepare your racket and pivot. You step with your left foot, and the ball is at waist level on the rebound ahead of your left foot alignment so you go ahead and stroke anyway because you've taken your step. There it goes, up toward the ceiling and maybe a little to the left also--or maybe you didn't even reach the ball. This is what happens if you misjudge and don't come up on the ball, don't get even with it, don't align your left foot with the point at which the ball is in the air when it's waist level. You're reaching forward, and you open up your racket face, and the ball goes up. Let's try it again.

Ready position. This time you say to yourself, "I'll move up." Here comes the ball. You prepare and



move up too soon--but, the tosser sent it deeper that time. It bounces and rebounds to waist level, but by the time it reaches waist level, it's behind you. There goes that shot off to the right again--the same one we recognize from the self-toss when you stepped ahead of the ball with your left foot and made racket contact opposite your right foot instead. That will happen if you misjudge the ball or you anticipate a particular kind of toss and that kind of toss doesn't materialize. So, wait and watch.

Ready position. This time you are saying to yourself, "I'll prepare in time." Be alert and look at the ball closely. Here it comes. It's short. You move up a couple of steps . . . turn . . . step with your left foot . . . stroke. There it goes--a good stroke.

Well, this isn't so hard. If the ball is high and deep you have to move back. If it's high and short, you have to move up. Also, if it's low and short, you have to move up, but in addition to that, you have to bend your knees and get very low as you turn your left shoulder to the net. Get your waist down lower to get the racket behind the ball. If it's low and deep be ready and get your knees well bent. You can predict the height of the rebound from the height or loft of the ball as it is coming toward you. But remember, the faster the ball is coming, the faster it will rebound. Be

ready to swing through a little sooner on a faster ball. Those are two common areas of error on a ball being tossed to you or a ball being tossed to you by a ball machine.

What other common error can occur? Let's talk about your grip for a moment. Let's say that you have the proper grip but all of your strokes seem to go into the net. You may be rolling your wrist over as you stroke so that the top edge of your racket leads and closes the face of the racket. In other words, the face is pointing down somewhat as you make contact with the ball, or just after contact with the ball. Keep the racket on edge throughout.

Try the closed racket face now. Ready position. Here comes the ball. Prepare . . . move into position . . . step and stroke. There's the ball coming into the strings. Meet it, then roll your hand over so that the palm is down on your follow through. There goes the ball--into the net. By closing your racket face, you put more top spin on the ball, causing it to drop sooner. You will recall that with the correct forehand, you have some top spin which allows you to aim three to six feet higher than the net and still have your ball drop into the court boundary. However, if you close the racket face as you stroke, you will add more top spin and perhaps hit it into the net. You will get a similar effect if you

stroke up the back of the ball without enough forward force. The latter may occur if you flip your elbow and bend it extremely on the follow through. It may also occur if you just simply stroke up the back of the ball rather than forward, into the direction of the stroke and up. Added top spin is used to advantage at times by advanced players, but you should leave it alone until you have a good deep groundstroke with just some top spin on it. The opposite of the closed face can occur if you do what I call "spooning" the ball. Imagine holding a spoon as you hold the racket, and spoon some ice cream out of a container. Your wrist rotates so that your palm turns up. This is great for ice cream! But on the forehand, you'll get an open racket face and a ball that goes skyward.

Let's try it. Slow motion. Ready position. The machine spits out a ball . . . here it comes . . . prepare . . . move to position . . . step and stroke. Just as the ball meets the strings you turn your palm up . . . and up goes the ball.

In both of these cases your grip was correct, but your wrist was loose. So, the lesson to be learned here is to keep the wrist firm with a firm grip. In the next pause on the tape, try both the closed face and open face errors caused by a turning wrist, and then do the stroke correctly. Do it both in slow motion and normal speed. Go ahead.

(Pause.)

The last error on this tape is what I call "giving up." It really means lack of follow through. What happens is that the player makes contact with the ball and then stops the forward motion of the racket. The result is a weak, slow, and many times short shot. These shots are easily played by your opponent and they put you on the defensive.

We needn't practice this error because we've stressed follow through from the very beginning of learning the forehand. Just be sure that your racket is pointing to the opposite wall, your racket hand is well in front of and level with your left shoulder, and your racket head is higher than your shoulder and on edge on the follow through.

These are some of the most common errors. You may have some of these, or you may have none of these. You may have an uncommon error. Try to analyze what you did wrong when the ball does not respond the way you planned--a solid deep shot. Better yet, now that you're aware of some of the causes of these errors, concentrate on the correct way.

Thank you for your attention. This is the end of Tape 2.

## C. BEGINNING TENNIS: FOREHAND, TAPE 3, MPEIEE

This is the last in a series of tapes designed to help you mentally practice the forehand.

On the last two tapes we have become aware of some of the more frequent errors associated with the forehand, mentally gone through the errors to try to feel them, and then mentally correct them. You have been asked to stroke the ball with stiff knees, a loose wrist, two faulty positioning situations (one in which you were too far back of the ball, and one too far forward of the ball), late racket preparation, incomplete follow through, and strokes without looking at the ball. These are the errors that you have been asked to practice once or twice and then feel the correction on those errors. After feeling the error, you were then asked to mentally practice with the correct stroke--first, without the ball, then with a self-toss, and then with a partner toss. The point of all this is to try to help you become aware of correct and incorrect technique. The assumption is that if you have more insight into the feelings of effective and ineffective technique, you can more effectively dispense with the errors and more rapidly improve your skill level.

By now you are certainly aware that the first consideration is preparation of the racket. The second is how you place the racket on the ball. The third is

how the racket comes off the ball. The assumption on this tape is that you can do these three things if you have time and can get into position. It is not always easy to get into the proper position to stroke correctly, and given this, it is not easy to know when to stroke. When a ball rebounds from the court, it is traveling fairly fast. You know that it will hit the court, rebound up and toward the baseline, reach a peak on its rebound, and momentarily stand still before it starts to drop again. The task of a beginner is to "wait" for the ball to stop (as gravity takes over), or to wait even longer as the ball starts to descend again toward its second bounce. You have to stroke it before it bounces again, but if you wait until the second descent, some of the speed will be off the ball, you will have more time to aim, and more time to get to the ball.

Now, I hope you have your eyes closed and are visualizing this as we talk about it, as we talk about the ball bounce and the timing on when to stroke. Let's just mentally visualize in slow motion together a ball coming out of the ball machine. You watch it come and step to the side of its line. It drops to the court, rebounds, and jumps toward the baseline as it continues upward. Then it stops and seems to hang motionless . . . and then begins to drop. By now it has slowed considerably. Of course, if you can stroke it as it is

suspended motionless, your stroke will be easier to make as the ball is literally sitting still. If you try to stroke it as it comes up off the court, not only is it moving, but it is moving faster than it will be if you stroke it as it begins to drop to the court for the second time.

Caution though. If you let it drop too low toward the court the second time, you will have to stroke up underneath the ball to get it over the net, as it will be lower than the net. So don't let it drop below waist level if you can help it. Ideally, you want to stroke the ball as it is motionless and waist level. Practically speaking, you want to stroke it after it has reached its peak on the rebound and when it drops to waist level.

Let's try now, in slow motion, stroking the ball at the three different times: on the rise (as it's coming up on its rebound), at the top of the rise (when it's motionless), and as it drops after it reaches its peak on the rebound. Ready, here comes the ball. Stroke it as it's coming up on the rebound. Chances are, if you made contact, the ball went out-of-bounds. Let's stop and think about that for just a second. Why did it go out-of-bounds? It's coming up off the court on its rebound. That means it's coming into your racket face at an angle from below. Given no spin at all on the ball, it's going to rebound from your racket face at





that same angle. So obviously, it's going to go up. If it comes in from below it's going to go up as it goes off the racket face.

Ready position again. Here comes the ball, very slowly. It's coming up off the rebound, reaches its peak and hangs there. Now stroke it. That is easier because the ball is hanging motionless. So whatever angle that you meet the ball with your racket face, that's the direction that it's going to go because it's just sitting there motionless. It's not coming into the racket face at an angle as it did before.

Let's try to visualize it, taking it after it reaches its peak, after it's motionless, as it's dropping down toward its second bounce. Ready position. Now it's coming very slowly. It hits, rebounds up. You wait. It reaches its peak and sits there. You wait. It starts to drop . . . and drops to waist level . . . and you step and stroke through.

Now, of those three points at which you can take the ball, the first one is the most advanced way to play the ball (something you should forget about until you have more tennis experience). The second way, at the top of the rise (where it's hanging motionless) is the best place to play it in terms of not having to worry about what angle it's approaching the racket face, but it may not be waist level, and we're trying to groove

these strokes so they're waist level. And, it will rush you a little bit more than it will if you do it the third way. So, what you want to do is watch the ball, watch it hit the floor, watch it rebound, watch it reach its peak, watch it come off its peak and start down again, then take it and stroke it. That will give you the most time.

In the next pause, will you try all of those three ways of taking the ball up to normal speed, assume a normal speed on the ball coming toward you, and try taking the ball at all three points. Go ahead.

(Pause.)

Now you've tried the three ways up to normal speed, and you should have been able to feel that the third way to play the ball is the one which you should give your attention to now as a beginner--at least in the beginning stages of being a beginner--because it gives you more time to get into position, get your racket ready, and it gives you a longer time to look at the ball.

We talked about too long a backswing on the previous tape, but we didn't actually experience it. Close your eyes and follow me. You're in your ready position at the center of the baseline. The ball is tossed to you out of the machine, you prepare your racket by bringing it back beyond pointing at the wall behind

you--much further back than that. It's almost pointing to the wall on your left, only it's wrapped around your back. You watch the ball but you do have some trouble seeing it as you are turned so far to the right. You bring your racket through. It's difficult to line the racket up with the ball. You swing forward and catch the ball just at the bottom edge of the racket--just a little late. The ball drops into the net. There was no way to keep the strings on the racket, as you were already at the bottom of the racket when you made contact with the ball.

Now, that's something that can happen if you take such a long backswing that it takes you so long to come through that you're simply late, and the ball drops lower than you expect it to, and it hits the bottom of the racket. Your stroke is impossible.

Now the ball comes out of the machine (slow motion again). You bring your racket back just 90°, you're standing facing the net, you bring your racket back just 90° (in other words, it's straight out towards your side), you turn, you watch the ball and wait. There it is right there to come into the bottom of the back side of the ball. Stroke through and up high. If you do that short backswing, so that you just bring it 90° (so it's pointing your arm and racket right out to the right side), and then, of course, you're turning

your body as you always do. Pivot, and then your racket will be about pointing at the wall behind you. That's as much backswing as you will ever need, and sometimes you will want an even shorter backswing. If you prepare and move (if it's necessary to move) immediately, the stroke will come easy if you watch the ball and wait for the right time to stroke. Your timing is somewhat the same as the self-toss except, of course, you don't put your foot in the same position in relation to the ball that you did with self-toss, but your timing is somewhat the same. The ball hits the court, and you call that the bounce. Then you step and then you stroke. Even though you're not stepping opposite where the ball hit, it's that kind of timing. So, it's bounce, step, stroke.

Let's take another stroke. Ready? Here comes the ball in slow motion. You prepare . . . you move . . . you wait . . . and then stroke just from your wrist down. Don't move anything else. How did it feel?

Try it again and stroke from your elbow and wrist. How did that feel? Try it again, and stroke from your shoulder--which is the way you should be stroking.

You can see that the racket face as it's presented to the ball is more consistent in the stroke from the shoulder. Not only that, but you cannot stroke the ball.

You can only hit it with the wrist and elbow movement. And remember, we said "hit" means one instantaneous contact, whereas stroke means that you stay with the ball, you press through on the ball, the ball rolls across the strings. You can't get that kind of a stroke if you're just using your wrist or your elbow and wrist. It's a sharp hit, and you have less control.

Try all three again, and try to feel the difference. This is not to say that there isn't any wrist or elbow movement there. There is. But you're generating your stroke from your shoulder.

Hold your racket out to your side and let the head drop down by loosening your grip. The head of your racket should drop below your wrist. Try a couple strokes with your racket head down like this. Try a couple strokes with a ball. Imagine the ball coming. Let your racket head drop loose like that and try stroking a couple of balls. Finish the follow through with the racket head down instead of up. That should have felt pretty weak. That's what happens when you put your wrist in a weak position when you don't have a firm grip on your racket.

Before we leave this tape, just a word about ball tracking. Don't be anxious to swing through fast when you get into position to stroke the ball. Be ready, but "wait" for the ball to be where you want it--either motionless or on the way down after it has reached the peak of its bounce.

That's enough errors to trouble you with today. I think that we've covered most of the errors that would be connected with the forehand. If you feel you need to listen to any of the tapes again to clarify these things, feel free to do so.

Now is the time to think positively. Take your ready position. Take your preparation. Track the ball and move to the approximate position. Turn, the ball bounces . . . step . . . wait . . . stroke . . . follow through. And that's your practice--your proper stroke practice for the forehand.

Thank you for your attention. This is the end of Tape 3 on the forehand.

## D. BEGINNING TENNIS: SERVICE, TAPE 1, MPEIEE

The service is different from all other tennis techniques in that you, the player, have complete control over all the variables related to the skill.

Wind and sun are the only uncontrollable factors to which a player must adjust, and for indoor play, even these do not exist. You control the placement of the ball into the air and the placement of the racket on the ball. With this in mind, given the motivation and opportunity to practice, you should be able to develop a reliable service.

The service has two essential parts: the placement of the ball (or the toss) and the swing of the racket to meet the ball. We will consider and practice these two separately and then put them together.

Close your eyes and imagine yourself behind the baseline, facing the curtain. Your left foot is at a 45° angle to the baseline and your right foot is comfortably back. The weight is on your back (or your right) foot. You have no racket in your hand. All instructions are for right-handed players. Now, take everything in slow motion again, unless otherwise indicated. Take a ball in your left hand, cradle it gently on your fingers--out toward the ends of your fingers--and secure it lightly with your thumb. Hold it waist level over your left foot. Bring your hand down toward the front

of your left thigh and then push straight up to a full arm extension. Release the ball as late as possible, but keep the palm of your hand facing up toward the ceiling--as if you were holding a glass of water on it. Continue to reach upward, and watch the ball go straight up, about eighteen inches above your reach or just higher than your reach with your racket. Your weight stays back. Then--catch the ball, or let it drop to the floor.

There are several errors which you should be aware of and experience consciously in order to avoid them.

First, if you toss or flip the ball up without a reach with your palm up, you will get an erratic placement.

. . . In slow motion again, place yourself at the baseline again--with your left foot at a 45° angle. Hold the ball in your left hand, but hold it tightly between your fingertips and thumb. Now, slowly go down with your hand toward your left thigh and up--but don't reach. Just release the ball as you flip your hand up. If you held onto the ball and flipped rather than pushing straight up, you flipped the ball back over your head. Try it again. Flip the ball up. (By "flip," I mean that there's no arm extension to reach up and guide the ball, and there's no palm up position but, instead, a palm back position.) That tosses the ball back up over your head. Now that's one of the common errors of the toss--not to



reach with the palm up and to place the ball up. Many people toss the ball and flip it without guiding it up.

Second, take the ball again and hold it correctly (out toward the ends of your fingers) but not tightly. Now this is the second error that you can make which is common on the toss. You're going to flip again, but since you're not holding the ball tightly, flip slowly. This is slow motion, and let the ball roll off your fingertips--no arm extension and no reach up. Chances are that the ball rolled off and out in front of you too far. For the correct toss, get the concept of pushing straight up . . . reach up . . . palm up. Place the ball up rather than tossing or flipping.

During the next pause on the tape, try directing the ball back over your head and out too far in front. Do this in slow motion and see what happens. After you see and feel what happens, practice the placement correctly several times in slow motion and then up to normal speed. You have one minute to practice the two errors--back over your head and out too far in front--then to practice up to normal speed with a good push up and a placement of the ball up over the left foot. Begin . . .

Now that you understand correct and incorrect ball placement, let's put the ball down and practice the swing of the racket by itself.

You are using the forehand grip. Take your proper foot position at the line, hold your racket in both hands, and point it toward the curtain. Your weight is on your back foot.

Now, slowly, bring the racket down past your right knee. Continue in that direction until the racket comes up behind you to point at the wall behind you. Continue on up and then bring the racket into your back, and then reach up, pushing up with your back foot. Reach over your right shoulder to meet an imaginary ball in front of and above your right shoulder at full reach. Continue on through to your left side.

The key checkpoints again are knee--wall--back--ball. The racket goes to your knee, to the wall behind you, to your back, and then to the ball. Try the swing slowly again (but continuously) and as you bring the racket into your back, be sure your elbow is high.

(Pause.) With the ball placement, in slow motion, take a ball in your left hand, racket in right hand, weight on your back foot. Start both hands together, moving down (your left hand toward the left thigh and right hand down past your right knee). Then both hands come up (left hand in front and right hand in back). Reach with your left hand and release the ball as your right hand (or your racket hand) comes into your back. Then, while the ball is motionless in the air (just before it

starts to drop), your racket comes through, reaching up and facing forward to meet the ball on the "nose." As you bring your racket forward, push with your back foot. Watch the racket meet the ball up there, above and in front of your right shoulder, and as you come through, finish down through your left side. (Pause.) As you come through on the ball, be sure that you flex your wrist after you press out on the ball. Right on the nose of the ball, flex your wrist to bring the ball down into the court, so you're pushing or pressing out and then pulling down with your wrist flexing down. I'll pause for one minute, and I'd like for you to try several serves up to normal speed. . . .

We talked about and experienced some errors associated with the toss. But what are some errors on the service which are unrelated to the toss?

Fortunately, you can groove your swing pattern by repeatedly practicing the swing of the racket so that few errors are attributable to the swing. Most faults on the serve as far as beginners are concerned are related to a poor ball toss or placement which forces a poor swing pattern in order to make the racket and the ball contact. In other words, if your toss is good and you have grooved your swing, your serve will probably be good.

There are, however, two errors to be aware of at this point. The first is that of "pushing" the ball rather than swinging freely. Now I mentioned pressing out on the ball, and as you make contact, you do press out, but because you're flexing your wrist you're swinging freely. Your wrist is loose and you're swinging freely. If you push the ball, you will restrict your swing. Once the racket starts moving, let it move freely and continue its path through the ball all the way over to your left side. Keep all joints, shoulder, elbow, wrist quite flexible, and flex your wrist as you come through the ball. Try one or two "pushy" serves now. That is--without follow-through and with a stiff wrist. (Pause.) Can you feel the difference--between the stiff wrist and the wrist that flexes as you press out on the ball? This is something that you need to be aware of and need to feel.

The second fault or error that is associated with the serve is a poor timing of the toss and the swing. This, of course, is somewhat related to the toss. For instance, if your toss is placed properly in relation to your left foot, and in front of your right shoulder, but tossed too high or too low, it will cause errors.

Try starting your serve properly--in slow motion--everything correct except that you toss too high. Now you must wait for the ball, you must wait for it to come down,

and this interrupts your swing so that you don't have a continuous swing.

Now try a proper serve in every respect except that you toss the ball too low. This will cause you to rush your swing and contact the ball on top. Pause. As you face the curtain, try several good serves up to normal speed--coordinating the toss and the swing. Let your racket swing freely.

For those who have a good overhand throwing action, to simplify everything we could simply say to put the ball up there with your left hand and then go get it with your racket. Not everyone has a good overhand throwing action. But the serving action of the racket is very similar to the good overhand throwing action, provided you're throwing a good distance.

In summary, if your toss is good, your serve will probably be good.

Now, for the next one-minute pause on the tape, take several good serves up to normal speed.

There's really only one way to learn any kind of physical skill and that's to practice it physically. However, an aid for you in learning the service will be to go through the service mentally when you don't have physical practice available; go through it mentally so that you can coordinate the two arms as they work together.

This is the end of Tape 1 on the service. Thank you for your attention.

## E. BEGINNING TENNIS: SERVICE, TAPE 2, MPEIEE

Today, we're still at the baseline but on the other side of it, and we're facing the net.

On the last tape, we were primarily concerned with good ball toss and good racket action--and the coordination or timing of the two. We did not concern ourselves about accuracy or aiming the serve into the service court. That is today's task.

As far as the placement of your feet at the baseline is concerned, we need to be more specific than we have been before. When you take your foot position prior to starting your serve (if your left foot is at a 45° angle to the baseline), it will be pointing at the right net post. Place your left foot.

Your right foot is comfortably back but, in addition, if you draw a line between your left toe and your right toe, the line should point at the service court into which you intend to serve. In other words, your right foot will shift slightly when you are serving into the right service court or the left service court. The left foot will always point at the right net post. Do not minimize the importance of care in properly placing your feet relative to each service court.

Take a position either to the right or left of the center mark on the baseline. If you are to the right of the mark, you're serving into the right service court

(diagonally opposite). If you are to the left of the center mark, you are serving into the left service court. Take a position. Get your weight back on the back foot.

Now, take a few serves at normal speed--and as you contact the ball, point your racket face at the service court into which you wish to place the ball. Remember, you are hitting the ball on the "nose" of an imaginary face that's drawn on the back of the ball. Hit with a flat or square racket face which is pointing at the appropriate service court.

Take a few correct serves during the pause. . . .

Now, just in case you need it, I'll give you some verbal reminders. As you take your position at the baseline, point your racket at the net, with both hands on the racket and with the left hand holding the ball. Both hands come down, both hands go up. Reach with left palm up. As you come into the back with your right hand, look at the ball and swing up and through to the left side. Continue several good serves.

(Pause.)

What are the possible errors in what we're doing today? We have, already, hopefully, eliminated any errors in the toss or in the timing. What are other possible errors that we encounter when we're trying to serve into a specific service court?

First, the position of your feet at the baseline can complicate your serve accuracy. Try placing your left foot parallel to the baseline rather than pointing it at the right net post. Now serve by tossing or placing the ball up over your left foot as before. Slowly. . . . (Pause.)

You should find it difficult to see the service court in this position and therefore to aim, as you are sideways to the court. Instead of hitting out and down on the ball, you will be hitting across the ball with a twisting motion of your body. Try it again. (Pause.)

It's certainly possible to serve this way, as you've seen people do this. But it's more difficult to learn and has no advantage.

A second fault that you can encounter when you are trying to serve into a particular area is not having your racket face pointing toward the target as you contact the ball. Take your proper position again. Slowly--get a good toss and try a serve with the racket face pointing left. (Pause.) What happened? Absolutely. The ball went to the left.

Try one with the racket face pointing to the right. (Pause.) Of course, the ball went to the right. There's nothing particularly mysterious about this, and if you can feel the position of the racket when it's pointing to the left and you can feel the position of



the racket when it's pointing to the right, you should be able to identify and learn the correct position of the flat or square racket face coming through on the ball. These face variations to the right and the left can result very easily if you do not have a firm grip on your racket.

When you serve, you want your service to go deep into the service court if possible. Remember, you have two chances to get the serve in on each point. If you miss the first one, you should learn from it by noting where the ball goes and making an adjustment on the second serve. For instance, if your serve goes into the net, you did one or a combination of the following:

(1) Your ball toss may have been too low--you may have contacted the ball on top and you drove it down into the net, contacted it on the forehead of the face of the ball.

(2) You may have flexed your wrist too soon on contact with the ball and hit down on top of it. (3) The ball was too far in front of your right shoulder causing you to reach forward and hit down. Try each of these mentally and in slow motion during the next pause. Toss too low, flexing your wrist too soon, and tossing too far in front and flexing your wrist down on top of it.

(Pause.)

Now, suppose your serve goes too long. You probably did one of the following: (1) The ball toss or placement of the ball was too high. You could not

get it down even though you flexed your wrist as you came through. Your contact was on the "chin" of the face. Imagine that imaginary face on the back of the ball. You're supposed to hit it on the "nose." If your toss goes too high, you may hit it on the "chin," and your serve goes too long. (2) Your toss or placement of the ball may have been too far back and you again contacted the ball on the "chin" and had no chance to break or flex your wrist. (3) You may have "pushed" the ball with a stiff wrist and tried to hit the ball too hard. There was nothing to bring the ball down. You should try each of these mentally and in slow motion during the next pause. Try a toss that is too high so that you hit on the "chin" of the face of the ball. Try one that's too far back; you again hit on the "chin" because you can't get your wrist flexed. Or, try pushing with a stiff wrist and hitting hard at the same time. (Pause.)

Your serve can go short or it can go long. It can also go right or left. If your serve goes left, your racket face was probably pointing left, or, you may have turned your racket face with a loose wrist as you came through on the ball and the ball was too far left so you came around the right side of the ball and spun it over to the left. Or sometimes your serve may go to the right. This is less common. In this case, the face was pointed right. Or you came across the back of the

ball from right to left, which would cause the ball to spin to the right. Try each one of these in slow motion. . . . Try your racket face pointing to the left. (Pause.) Try turning your racket face as you come through on the ball, coming around the right side of the ball, to cause it to go left. (Pause.) Try turning your racket face to the right. (Pause.) Or what's even more fun, try coming across the back of the ball from right to left--which is not common but some people do it--and the ball goes to the right. Try that. (Pause.)

There are a couple of more things that may cause you to be inaccurate. If you don't meet the ball in the middle of the racket, you're probably not watching the racket make contact with the ball. Or your timing with the toss is off.

Try now to establish a rhythm in your serve. Do not rush into your serve but place your feet properly. Always look at the service court into which you're serving prior to starting your motion. Place your toss carefully. Start both hands moving together. Once your swing starts, it should be continuous if your toss is the right height to make contact just as the ball is "sitting still" between its up and down path. Aim your service but swing through freely. Remember that accuracy or placement is of primary importance. You must get it into the court, but you must swing freely and loosely.

Take about twenty serves up to normal speed--twenty serves into each service court during the next pause on the tape. (Pause.)

Keep working on the rhythm of your serve.

(Pause.)

Remember that you are the only one that has any control over your serve and you can learn to control it. All you need to do is practice. Don't underestimate your mental practice.

Thank you for your attention. This is the end of Tape 2 on the service.

## F. BEGINNING TENNIS: SERVICE, TAPE 3, MPEIEE

On the previous two tapes, we have worked on the beginner's serve to give you a full serving motion with which to start the point in the game. The serving motion is essentially the same for all serves regardless of how advanced you may become. There are differences which result, however, with different types of serves. On this tape, I should like to give you the details on executing a simple spin serve. This serve should be of interest to those of you who can consistently control your serve--in other words, get six or seven out of ten chances on your serves into the service court. Those of you who can do that--get 75 percent of your serves in--may be interested in the simple spin serve and should move on to it. Do not practice this though, unless your other serve is reliable.

There are only two differences between this serve and the one you have already learned: the grip and the action of the racket on the ball. Instead of using the eastern forehand, you will turn the racket clockwise as you hold it out in front of you in the ready position. Loosen your grip and turn the racket clockwise (or to the right) so that the knuckle at the base of your forefinger is almost on the top of the grip where the V was before for the forehand grip. This will cause the racket face to meet the ball on a slight angle rather than straight

in behind as on the other serve. As you meet the ball on the nose (you're still meeting the ball on the nose), and as you flex your wrist, the racket strings will scoot up and off the nose and over the left eye on the face of the ball. This will give the ball some side and top spin. Take care not to meet the ball on the nose and go off over the left ear as this will give you too much side spin. Your toss is the same and your swing is the same. Let's try it in slow motion. Position your feet at the baseline, hold the racket in both hands and point the racket head toward the net. Look at the service court, weight on the back foot. Now start both hands down, then up, then release the ball, reach with the left hand and bring the racket to your back, now go up to meet the ball with your racket. Plant the strings on the nose and slide up over the left eye. Follow through.

You probably noticed that your serve didn't feel solid or the ball didn't go as fast. This is as it should be. Any time you are creating spin on the ball, you are meeting the ball with a glancing blow, so to speak, and you lose some of the force. You should be meeting the ball on the nose, your racket traveling upward on your arm extension. As the arm continues to extend fully, the strings go up and over the top right side of the ball. The ball will rise as it comes off the strings and then begin to drop from the spin. You are aiming up and out,

and the ball should clear the net as high as it did on the previous serve--perhaps even higher.

What are the errors you might encounter on this serve? The most prominent error in learning this serve is coming around the "left ear" on the ball face rather than going up over the "left eye" on the top right side of the ball. This will result in pronounced side spin to the left. Your ball will spin left in the air and it will spin left after it lands. Side spin is not difficult to return if it is a consistent pattern and also has little pace or speed. It's not a bad serve once in awhile as an element of surprise, but it's certainly not the kind of serve that you want to rely on. You want top and side spin.

Try a few serves now, coming around the "left ear." Do it in slow motion so that you can see. Look at this in your imagination now and see--the action on the ball. The ball will be rotating from left to right on its own axis, as your racket wraps around the right side of the ball or around the "left ear" on the face of the ball. Now you're practicing an error, so do it in slow motion and see if you can see the action on the ball. (Pause.) Did you see it? Could you see what happens?

A second error is brushing up the back of the ball so much that you don't get enough forward motion

or you don't get enough racket on the ball or enough force into the ball. You get top and side spin but sacrifice too much speed.

Try this in slow motion and watch the action on the ball. Visualize it, look at it, see what happens as the ball rotates forward on its own axis. (Pause.)

There's another error that will result. It's probably not an error; it's more an ineffective action that will result if you reach full arm extension before you make ball contact. Then you will be back to your original beginning serve as there will be no upward action of the strings on the ball and therefore no top spin, no side spin.

You must, in order to have an effective serve which does more than just get the ball into the court, keep your shoulders, elbow, and wrist loose and flexible but keep a firm grip and get your own serving rhythm. This takes practice. Do not try to develop this simple spin serve if your other serve is not 75 percent accurate.

Now you should try on the next pause on the tape, twenty serves into the left service court. Don't forget to change your right foot position--and twenty serves into the right service court with the simple spin serve. Now you will find that your point of aim will have to be slightly more toward the center of the court as you serve into the right service court and more to the outside



of the court as you serve into the left service court, because your ball will be spinning slightly left in addition to having top spin. Try twenty serves into each court during the next pause on the tape. (Pause.)

Now we haven't talked much about how to develop more speed in the serve, but there are several factors that enter into that and one of them is your follow-through. As you follow through, rather than stepping into the court or thinking that that provides force, bend forward from the waist as you swing round with the racket on your left side and let your buttocks stick out behind. That will give you (as the trunk is swung downward forcefully) more speed on your serve. As you try to increase speed in your racket swing, you may have to adjust your toss and toss lower than you have been as you were learning the serve. This is the end of Tape 3 on the service. Thank you again for your attention.

## EXHIBIT C

## PLACEBO TAPES: PMP (MENTAL PRACTICE CONTROL)

Six placebo tapes were utilized in this research. Information and some content in the development of these tapes was taken from the following sources:

1. Barnaby, John N. Advantage Tennis. Boston: Allyn and Bacon, Inc., 1975.
2. Mason, Elaine. Tennis. Boston: Allyn and Bacon, Inc., 1974.
3. Murphy, Chet, and Murphy, Bill. Tennis for the Player, Teacher, and Coach. Philadelphia: W. B. Saunders Company, 1975.

The placebo tape that follows is a representative sample of the placebo tapes used.

## A. BEGINNING TENNIS: SERVICE, TAPE 3, PMP

I am going to deviate from what we have been doing, to talk about watching tennis. There is, I believe, a great deal to be gained from watching tennis--probably as much as there is by mentally practicing.

As thousands of new fans are created by the current tennis explosion, it is clear from the reactions in the galleries that many have little idea of what is going on before their eyes. Not having watched much tennis, they have confined their attention to the ball and, thereby, miss many fine points which have a decisive effect on what occurs.

There are actually a good many different ways to watch a match, and spectators--particularly those wishing to learn something for the benefit of their own game--would do well to vary their manner of watching. What follows describes a few of the spectating tricks that can be very rewarding in perceiving what a player is doing and how he does it. This can apply to technique, tactics, and strategy.

We have around this campus many opportunities to watch good tennis. Keep your eye on the server even after he has played the ball. If he takes the net, watch how he moves in quickly after serving, then hesitates, crouched, ready to break to either side for the return. Watch where he puts his first volley and the



position that he takes up in anticipation of the second return--always crouched. Note how he anticipates--forward, seldom sideways--so as to get on top of the net. Watch his quick reaction when the opponent lobs. You can see just how he does this by not watching the ball and just watching him, all the way. I am using the term "him" generically, of course!

Take note of where the defender stands to receive the service. If the service is severe, note his abbreviated swing and how he tries to move his weight into the ball to get solidity into his shot. When he tries a passing shot in the subsequent exchange, watch his racket technique. Does he hit it flat and hard, or does he spin it a lot to make a dipping angle shot? How good is he at lobbing the second or third shot? Does he do it? What do you think he is thinking? Does he strike out daringly on his return of service, playing for lucky winners, or does he play for the server's feet, trying to get him into trouble rather than trying for a winner? What is his plan? How often does he return cross court rather than down the line? Is his plan the same off his forehand and backhand, or does he return differently off the two sides? If you keep watching him alone, you can often discern a great deal of his thinking in the battle of wits he wages against the opponent.

Tennis is a thinking game. Get with it. The greatest servers are often confronted by the greatest defenders. Keep mental track of how often the server uses his bomb, how often he breaks one out wide to the forehand in the right court, how often he serves directly at the receiver, how often he changes the speed and break of the ball by increasing or decreasing the amount of spin, how often he curves on in close to cramp the receiver. All of these tricks are comparable to the baseball pitcher who mixes up fast balls, hooks, sliders, slow balls, etc. A great server doesn't just hit the ball well, he is a canny thinker who usually manages to keep his opponent guessing a little and off-balance both mentally and physically. By concentrating on the service alone, you can achieve considerable perception into what each is doing to the other. This makes it all that much more interesting for you.

There are advantages to watching tennis on a slow surface. Composition courts are slower than grass, hard courts, and synthetics. The defender has a much better chance to achieve respectability with his return, thus forcing a more lengthy exchange. While the server still has an advantage, it is no longer as decisive as it was on a fast surface. This makes for much more interesting tennis. Instead of the eternal net player against the baseline defender, we see some baseline rallies, a battle

of the backhand, and shots that are just about totally missing in fast court tennis. Shots such as the drop shot have now become part of the game again. More varied techniques and tactics are demanded.

On fast surfaces, all good players are forced into one type of offense--to follow serves to the net. The defender is thus confined to limited choices. Play for his feet as he comes in, strike out for a winner, bang it right at him, or lob. On the composition court he has more options. His opponent is not always at the net; he can attack one side of his opponent's game and try to break it down. He can use slices to create a kick-bounce, hoping to hurt the other fellow's timing. When he gets a short ball, he can attack all four corners of his opponent's court, using drop shots as a variation from hard hitting. His opponent must bear all this in mind when the crisis occurs. There are many more opportunities for retrieving and angling and a high deep lob is very difficult to kill. He can be a counter player using his opponent's power to his own ends. Agility and court covering and steadiness pay great dividends.

Altogether, the complete tennis player is the clay court player, and spectators have far more opportunity to see all the possibilities of the game on clay than on fast court. The court surfaces that we have here at the College are called "all-weather" surfaces. They are

hard and fairly fast. They are not as fast as grass, they are faster than clay courts, but they are slow enough so that it is not the big serve/volley game that we see.

When you are watching for technique, it is important not to watch the ball. Watch one player. Watch him prepare his racquet and feet. Watch his racket leave the ball as well as come to it. Watch what he does almost to the total exclusion of the ball. While ordinary spectators are interested in the action and the result of the exchange, the technical analyst is interested in only what the player actually does with himself and his racket. The most difficult thing to do is to watch the racket leave the ball. The follow-through shows a great deal of what actually happens to the ball spin and to the weight pace. Watch what a player does all of the time. Notice, for instance, that Billie Jean King always hits her second service deep. It isn't a winner, but she has the advantage and wins the percentages.

You should spend half of your time watching the receiver. Have your eyes on the receiver when the ball is being served, not on the server. The natural thing to do is watch the server and follow the ball to the receiver. By this time, the receiver's racket is playing the ball. You didn't see at all how he reacted and how his racket got there. Thus, as a rule, spectators learn



little about defensive tricks. Receiving deserves 50 percent of our attention. It takes a little effort, but it is well worth it.

Doubles is a team sport. Most of those in the huge tennis audience think tennis is an individual sport. Actually, doubles is more interesting to watch than singles because there are many two-shot plays in which one player creates an opportunity and his partner capitalizes. There are many planned moves, poaches, half poaches, and even rotation whereby one team attempts to confuse the other. There is much going on. The players not playing the ball move a great deal, anticipate, cut in, retrieve, etc. All tennis spectators should become familiar with doubles and, as in singles, should at times purposely avoid watching the ball and, instead, concentrate on one player exclusively--the receiver, the receiver's partner or the server's partner. It is probably a reasonable prediction that doubles spectating will grow in popularity as the new tennis audience comes to understand and appreciate it. It is the best game for spectators.

**APPENDIX C**

**COMPOSITE SCORE SHEET**

**APPENDIX C**  
**COMPOSITE SCORE SHEET**

| Sub-<br>ject<br>No. | Forehand |      |       |      | Service |      |       |      | Sub-<br>ject<br>No. | Forehand |      |       |      | Service |      |       |      |
|---------------------|----------|------|-------|------|---------|------|-------|------|---------------------|----------|------|-------|------|---------|------|-------|------|
|                     | Form     |      | Perf. |      | Form    |      | Perf. |      |                     | Form     |      | Perf. |      | Form    |      | Perf. |      |
|                     | Pre      | Post | Pre   | Post | Pre     | Post | Pre   | Post |                     | Pre      | Post | Pre   | Post | Pre     | Post | Pre   | Post |
| 1                   | 13       | 21   | 41    | 48   | 22      | 30   | 19    | 19   | 27                  | 15       | 30   | 35    | 51   | 6       | 24   | 14    | 8    |
| 2                   | 23       | 28   | 38    | 32   | 18      | 16   | 4     | 5    | 28                  | 7        | 28   | 17    | 41   | 16      | 29   | 12    | 10   |
| 3                   | 6        | 16   | 16    | 30   | 4       | 23   | 6     | 22   | 29                  | 29       | 33   | 30    | 48   | 16      | 27   | 6     | 14   |
| 4                   | 12       | 28   | 26    | 14   | 13      | 23   | 4     | 6    | 30                  | 9        | 16   | 23    | 24   | 14      | 30   | 0     | 14   |
| 5                   | 24       | 22   | 32    | 36   | 22      | 25   | 13    | 6    | 31                  | 18       | 26   | 40    | 47   | 23      | 34   | 14    | 11   |
| 6                   | 14       | 26   | 2     | 27   | 25      | 21   | 6     | 1    | 32                  | 16       | 30   | 37    | 34   | 7       | 30   | 15    | 8    |
| 7                   | 28       | 27   | 23    | 22   | 32      | 30   | 15    | 16   | 33                  | 16       | 29   | 19    | 30   | 21      | 17   | 14    | 5    |
| 8                   | 16       | 29   | 22    | 33   | 14      | 24   | 18    | 14   | 34                  | 15       | 28   | 36    | 37   | 1       | 28   | 6     | 5    |
| 9                   | 4        | 23   | 8     | 44   | 17      | 24   | 16    | 12   | 35                  | 17       | 25   | 14    | 38   | 16      | 24   | 6     | 10   |
| 10                  | 27       | 24   | 36    | 41   | 30      | 33   | 20    | 5    | 36                  | 23       | 28   | 23    | 29   | 30      | 31   | 4     | 0    |
| 11                  | 11       | 23   | 11    | 9    | 16      | 27   | 5     | 3    | 37                  | 15       | 20   | 19    | 13   | 18      | 26   | 9     | 8    |
| 12                  | 27       | 35   | 54    | 47   | 33      | 35   | 29    | 16   | 38                  | 16       | 27   | 9     | 54   | 5       | 28   | 6     | 12   |
| 13                  | 1        | 21   | 17    | 18   | 4       | 33   | 6     | 12   | 39                  | 16       | 27   | 4     | 23   | 9       | 28   | 8     | 11   |
| 14                  | 11       | 24   | 25    | 28   | 1       | 17   | 16    | 4    | 40                  | 14       | 21   | 34    | 37   | 29      | 25   | 4     | 8    |
| 15                  | 1        | 16   | 14    | 21   | 4       | 21   | 13    | 7    | 41                  | 24       | 34   | 15    | 13   | 28      | 33   | 4     | 10   |
| 16                  | 4        | 31   | 25    | 34   | 18      | 18   | 14    | 17   | 42                  | 24       | 35   | 34    | 42   | 28      | 30   | 18    | 9    |
| 17                  | 22       | 28   | 10    | 36   | 17      | 32   | 12    | 12   | 43                  | 27       | 29   | 39    | 39   | 26      | 29   | 16    | 8    |
| 18                  | 15       | 26   | 10    | 27   | 14      | 28   | 7     | 8    | 44                  | 17       | 11   | 40    | 49   | 32      | 35   | 27    | 28   |
| 19                  | 27       | 26   | 24    | 38   | 1       | 35   | 23    | 18   | 45                  | 19       | 33   | 26    | 37   | 22      | 27   | 9     | 3    |
| 20                  | 13       | 30   | 36    | 30   | 19      | 29   | 18    | 2    | 46                  | 19       | 17   | 13    | 36   | 24      | 27   | 5     | 9    |
| 21                  | 2        | 33   | 45    | 40   | 1       | 28   | 17    | 17   | 47                  | 7        | 27   | 22    | 32   | 2       | 11   | 15    | 12   |
| 22                  | 24       | 28   | 24    | 37   | 23      | 29   | 4     | 0    | 48                  | 22       | 15   | 23    | 31   | 29      | 28   | 4     | 16   |
| 23                  | 18       | 19   | 26    | 36   | 33      | 29   | 4     | 18   | 49                  | 14       | 15   | 18    | 23   | 29      | 31   | 25    | 11   |
| 24                  | 30       | 25   | 40    | 45   | 34      | 35   | 32    | 18   | 50                  | 6        | 22   | 13    | 26   | 29      | 29   | 3     | 4    |
| 25                  | 11       | 27   | 14    | 32   | 1       | 28   | 16    | 6    | 51                  | 7        | 21   | 12    | 24   | 1       | 29   | 13    | 3    |
| 26                  | 16       | 7    | 22    | 23   | 15      | 33   | 8     | 8    | 52                  | 17       | 22   | 37    | 50   | 1       | 32   | 14    | 0    |

## **APPENDIX D**

### **MENTAL PRACTICE SCHEDULE**

APPENDIX D  
MENTAL PRACTICE SCHEDULE

IMPORTANT--PLEASE READ CAREFULLY AND NOTE

To: ALL STUDENTS IN MY BEGINNING TENNIS CLASSES

From: TISH LOVELESS

Re: ASSIGNMENTS AND CLASS REQUIREMENTS

Some of you were not in attendance the first class period when the procedures and requirements for credit in this class were explained. They are as follows:

1. Instruction begins on the hour.
2. Class is dismissed fifteen minutes before the hour (except for those assigned extra practice).
3. The usual limit of three absences in order to receive credit is in effect.
4. As I explained the first day, there will necessarily be other requirements for credit as these tennis classes are providing data for a study concerned with investigating effective ways of learning motor skills. The knowledge gained may help you and others. The additional requirements are:
  - a. Listening to the audio tapes on reserve in the library when assigned.
  - b. Listening only to the type of tapes assigned to you. Ask the person at the circulation desk for the tape by Type (Type I, Type II, or III) as assigned to you.
  - c. Taking the posttest on the forehand and serve, March 2 through 8th, at the end of the term.

I shall greatly appreciate your cooperation in this class and hope that you will see significant improvement, enjoyment, and understanding of tennis.

The schedule for tape listeners is:

Mon. Jan. 17 to Wed. Jan. 19 - Listen to Tape 1 Forehand  
once (15 min.)

or

Tues. Jan. 18 to Thurs. Jan. 20

Wed. Jan. 19 to Mon. Jan. 24 - Listen to Tape 2 Forehand  
once (15 min.)

or

Thurs. Jan. 20 to Tues. Jan. 25

Mon. Jan. 24 to Wed. Jan. 26 - Listen to Tape 3 Forehand  
once (15 min.)

or

Tues. Jan. 25 to Thurs. Jan. 27

Wed. Jan. 26 to Mon. Jan. 31 - Listen to Tape 1 Service  
twice (15 min.)

or

Thurs. Jan. 27 to Tues. Feb. 1

Mon. Jan. 31 to Wed. Feb. 2 - Listen to Tape 2 Service  
once (15 min.)

or

Tues. Feb. 1 to Thurs. Feb. 3

Wed. Feb. 2 to Mon. Feb. 7 - Listen to Tape 3 Service  
once (15 min.)

or

Thurs. Feb. 3 to Tues. Feb. 8

NO LISTENING REQUIRED DURING BACKHAND INSTRUCTION

Mon. Feb. 21 to Wed. Feb. 24 - Listen to one tape, FH or S  
once (15 min.)

or

Tues. Feb. 22 to Thurs. Feb. 24

Wed. Feb. 23 to Mon. Feb. 28 - Listen to one tape FH or S  
once (15 min.)

or

Thurs. Feb. 24 to Tues. March 1

Mon. Feb. 28 to Wed. March 2 - Listen to Tape 3 Forehand  
once (15 min.)

or

Tues. March 1 to Thurs. March 3

Wed. March 2 to Mon. March 7 - Listen to a Service tape  
once (15 min.)

or

Thurs. March 3 to Tues. March 8

**APPENDIX E**

**RATING SHEETS**

## APPENDIX E

### FOREHAND--RATING SHEET FOR BEGINNERS EXHIBIT A

Rater No. \_\_\_\_\_

Subject No. \_\_\_\_\_

Instructions: Rate each stroke (10 in all) on each of the first three items.

- (1) For items 1 through 3, cross out (X) the appropriate box if 2 of the 3 criteria are evident.
- (2) For item 4, give one overall rating 0 to 5 based on criteria listed in number 4.
- (3) Finally--give your opinion on whether this is a pretest or posttest.

1. READY POSITION - A. Racket in both hands--racket head pointing toward net and on edge.  
B. Knees noticeably bent.  
C. Weight forward over balls of feet.
2. PREPARATION--(Body & Racket)  
A. Turn left shoulder to net.  
B. Racket back soon enough to stop on backswing (or) small continuous backswing loop.  
C. Racket pointing at wall behind (avoid longer or shorter backswing) and racket head about waist level (avoid high or large looping backswing)
3. STROKE  
A. Step toward net with left foot just prior to stroke, knees bent & weight into stroke.  
B. Racket path into the ball approx. parallel to court surface or, in line behind the ball (avoid scooping under), racket head nearly on edge throughout stroke.  
C. Follow through until racket points to opposite wall (or beyond), racket head finishes high in front of and above left shoulder and higher than wrist. (Avoid "elbow only" stroke.)
4. RATE WHOLE STROKE EXECUTION  
A. Good balance--Both feet remain on floor--knee bend and weight into stroke  
B. Smooth "stroke" rather than "hit"  
C. Firm Grip  
D. No evidence of "wristy" or "pushy" stroke  
E. Good racket head speed and timing



|                                              |                   | NUMBER OF STROKES |   |   |   |   |   |   |   |   |    |
|----------------------------------------------|-------------------|-------------------|---|---|---|---|---|---|---|---|----|
| 1.                                           | READY<br>POSITION | 1                 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 2.                                           | PREPARATION       | 1                 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 3.                                           | STROKE            | 1                 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| TOTAL EACH STROKE                            |                   |                   |   |   |   |   |   |   |   |   |    |
| 4. GIVE ONE OVERALL RATING (ZERO TO 5) _____ |                   |                   |   |   |   |   |   |   |   |   |    |

Total Score \_\_\_\_\_  
Maximum 35

Vertical total 1 through 3 for each  
stroke plus the one value given in  
number 4.

Rater No. \_\_\_\_\_

Subject No. \_\_\_\_\_

Rater's Opinion: Cross out  
appropriate box:

This is a 

|     |      |
|-----|------|
| PRE | POST |
|-----|------|

 Test



|                                              | NUMBER OF STROKES |   |   |   |   |   |   |   |   |    |
|----------------------------------------------|-------------------|---|---|---|---|---|---|---|---|----|
| 1. STARTING POSITION                         | 1                 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 2. INITIAL PHASE                             | 1                 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 3. FINISH PHASE                              | 1                 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| TOTAL EACH STROKE                            |                   |   |   |   |   |   |   |   |   |    |
| 4. GIVE ONE OVERALL RATING (ZERO TO 5) _____ |                   |   |   |   |   |   |   |   |   |    |

Total Score \_\_\_\_\_  
 Maximum 35

Rater No. \_\_\_\_\_

Subject No. \_\_\_\_\_

Rater's Opinion: Cross out appropriate box:

This is a 

|     |      |
|-----|------|
| PRE | POST |
|-----|------|

 Test.

## **APPENDIX F**

### **SCHEDULE OF CLASSES FOR DATA COLLECTION**

# APPENDIX F

## SCHEDULE OF CLASSES FOR DATA COLLECTION

### BEGINNING TENNIS WINTER TERM 1976-77

#### Section 1--11:00 Mon-Wed.

M Jan. 3 Orientation  
W Jan. 5 Pretest Forehand  
Video Tape (VT)  
M Jan. 10 Pretest Serve  
Video Tape

#### Sections 2 & 3--10:00 & 11:00 Tues-Thurs.

T Jan. 4 Orientation  
Th Jan. 6 Pretest Forehand  
Video Tape  
T Jan. 11 Pretest Serve  
Video Tape

Schedule Revised--No Classes Jan. 11 due to Blizzard

|                             |                                                  |
|-----------------------------|--------------------------------------------------|
| W Jan. 12 1st Lesson Volley | Th Jan. 13 Pretest Serve                         |
| M Jan. 17 1st Lesson FH     | T Jan. 18 1st Lesson FH                          |
|                             | Listen to Tape 1 once before Lesson 2 15 min.    |
| W Jan. 19 2nd Lesson FH     | Th Jan. 20 2nd Lesson FH                         |
|                             | Listen to Tape 2 once before next Lesson 15 min. |
| M Jan. 24 3rd Lesson FH     | T Jan. 25 3rd Lesson FH                          |
|                             | Listen to Tape 3 once before next lesson 15 min. |
| W Jan. 26 1st Lesson Serve  | Th Jan. 27 1st Lesson Serve                      |
|                             | Listen to Tape 1 once before Lesson 2 15 min.    |
| M Jan. 31 2nd Lesson Serve  | T Feb. 1 2nd Lesson Serve                        |
|                             | Listen to Tape 2 once before Next Lesson 15 min. |
| W Feb. 2 3rd Lesson Serve   | Th Feb. 3 3rd Lesson Serve                       |
|                             | Listen to Tape 3 once before next Lesson 15 min. |
| M Feb. 7 1st Lesson BH      | T Feb. 8 1st Lesson BH                           |
|                             | No Listening                                     |
| W Feb. 9 2nd Lesson BH      | Th Feb. 10 2nd Lesson BH                         |
|                             | No Listening                                     |
| M Feb. 14 3rd Lesson BH     | T Feb. 15 3rd Lesson BH                          |
|                             | No Listening                                     |
| W Feb. 16 FH-BH-Serve       | Th Feb. 17 FH-BH-Serve                           |
| M Feb. 21 FH-BH-Serve       | T Feb. 22 FH-BH-Serve                            |
|                             | Listen to one tape once 15 min.                  |
| W Feb. 23 FH-BH-Serve       | Th Feb. 24 FH-BH-Serve                           |
|                             | Listen to one tape once 15 min.                  |
| M Feb. 28 FH-BH-Serve       | T Mar. 1 FH-BH-Serve                             |
|                             | Listen to Tape 3 FH 15 min.                      |
| W Mar. 2 Posttest FH--VT    | Th Mar. 3 Posttest FH--VT                        |
|                             | Listen to Tape 3 Service 2 tapes                 |
| M Mar. 7 Posttest Serve--VT | T Mar. 8 Posttest Serve--VT                      |
|                             | 2 tapes                                          |
| W Mar. 9 Posttest Backup    | Th Mar. 10 Posttest Backup                       |

**APPENDIX G**

**INSTRUCTIONS TO LIBRARIAN**

APPENDIX G  
INSTRUCTIONS TO LIBRARIAN

IMPORTANT

To: Circulations Librarian, Upjohn Library, Kalamazoo College  
From: Tish Loveless, Department of Physical Education  
Re: Audio tapes on closed reserve for beginning tennis, winter term, 1977

THERE ARE THREE TYPES OF TAPES. THERE ARE THREE LISTS OF STUDENTS.

PLEASE, it is of vital importance to the data collection for my Doctoral thesis that:

1. Only students on Type I (MPP) list are given Type I (MPP) tapes.
2. Only students on Type II (MPEIEE) list are given Type II (MPEIEE) tapes.
3. Only students on Type III (PMP) list are given Type III (PMP)

LISTS OF STUDENTS ARE ATTACHED TO EACH BOX.

These students have been asked to listen ONLY to the tapes assigned to them.

Your help is appreciated in directing the right type tape to each student.

THANK YOU!

**APPENDIX H**

**TAPE LISTENING RECORD**



# APPENDIX H

## TAPE LISTENING RECORD

Minimum Listening Record for Retention in the Study--6

| <u>Verbal</u> | <u>Study Number</u> | <u>Tape Count</u> |
|---------------|---------------------|-------------------|
|---------------|---------------------|-------------------|

### MPP (MENTAL PRACTICE POSITIVE)

|      |    |    |
|------|----|----|
| High | 1  | 6  |
| Low  | 2  | 8  |
| Low  | 3  | 0  |
| High | 4  | 10 |
| High | 5  | 11 |
| Low  | 6  | 12 |
| Low  | 7  | 11 |
| Low  | 8  | 0  |
| High | 9  | 8  |
| High | 10 | 3  |
| Low  | 11 | 4  |
| Low  | 12 | 2  |

### MPEIEE (MENTAL PRACTICE ERROR INFORMATION, EXPERIENCE, ELIMINATION)

|      |    |    |
|------|----|----|
| High | 13 | 12 |
| High | 14 | 9  |
| High | 15 | 7  |
| Low  | 16 | 11 |
| Low  | 17 | 9  |
| High | 18 | 10 |
| High | 19 | 9  |
| Low  | 20 | 10 |
| Low  | 21 | 8  |
| Low  | 22 | 11 |
| High | 23 | 10 |
| High | 24 | 5  |
| Low  | 25 | 6  |
| Low  | 26 | 6  |

### PMP (MENTAL PRACTICE CONTROL)

|      |    |    |
|------|----|----|
| High | 40 | 12 |
| High | 41 | 6  |
| High | 42 | 7  |
| Low  | 43 | 13 |
| High | 44 | 9  |
| High | 45 | 11 |
| Low  | 46 | 11 |
| Low  | 47 | 10 |
| Low  | 48 | 11 |
| Low  | 49 | 10 |
| High | 50 | 0  |
| Low  | 51 | 0  |
| Low  | 52 | 0  |

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## SELECTED BIBLIOGRAPHY

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