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Effect of humor on collegiate tennis players' performance on a tennis skills test

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The Effect of Humor on Collegiate Tennis Players' Performance on a Tennis Skills Test

By

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Date
Humor has been proven to have beneficial effects on health (Dillon et al., 1985), hope (Fry, 1987), relaxation (Prerost & Ruma, 1987), learning (Ziv, 1988), and academic task performance (Laurence & Siegel, 1984). Similarly, those rated as having a good sense of humor were reported to have higher levels of disease-fighting immune cells (McClelland, Ross, & Patel, 1985) as well as lower Beck Depression Inventory scores (Nezu & Blissitt, 1988) than those rated as having a low sense of humor. In general, women are more appreciative of humor than men while men tend to create humor more than women (Ziv, 1985). Laughter produces a unique level of consciousness which provides a broad outlook, permitting great mental flexibility and the ability to see many solutions to a problem. Studies indicate that laughter stimulates both hemispheres of the brain at the same time, coordinating all the senses and producing a unique level of consciousness and the highest possible level of brain processing (Svebak, 1977).

Since little research exists regarding the effect of humor on athletes' sport performance, the purpose of this study was to determine differences in competitive varsity men and women tennis players' level of state hope and state affect as well as differences in their performance of a skills test among the introduction of a stimuli widely regarded as humorous and two other conditions: introduction of a neutral stimulus and no stimulus. Subjects (N=13) were university women (n=5) and men (n=8) varsity tennis players. They completed both the State Hope Scale (Snyder, Symson, et al., 1996) and the Brief Assessment of Mood (BAM) (Whelan & Meyers, unpublished manuscript) before and after three conditions: a control condition (sitting quietly) and two experimental conditions (watching a neutral videotape, watching a humorous videotape). Following the humorous video, women's level of negative feelings dropped significantly (p=.016). This finding supports research showing an inverse relationship between negative mood state (anxiety, fatigue, and hostility) and humor (Mannell & McMahon, 1982).

To tap performance differences, the effects of the three conditions were also assessed by subjects' scores on the Purcell (1981) Tennis Forehand and Backhand Drive Test. A two-way repeated measures analysis of variance (ANOVA) for skills test scores after each of the three conditions [2(M,F) X 3(C1, C2, C3)] was performed to see if subjects' total score varied by either condition or gender. No significant interaction between condition and gender was found (p=.892). There were also no significant main effects for condition (p=.903) or gender (p=.945). Further experimentation with a larger sample size and a performance measure more closely resembling actual competition is suggested.
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And to my other "friends of Bill:" Jerry B.(in memory - you were like a dad to me - I miss you), Rich, Oscar, Sally, Greg, Bob, Bill, Steve, Kaye, Bonnie, Michelle, Dave, and Joel. Joel, my deleting part of my thesis and subsequent "all-nighter" here at Lew's office is made more bearable because 7 hours ago, you and Gene helped me to celebrate the Marlins beating your Indians in 12!!

And Thank you God, for being there.
Dedication

This project is dedicated to the memory of my parents:

Joyce Marie Bernuth (1936-1996) and Herbert Waldemar Bernuth (1927-1997).

Thanks for teaching me about the goodness of humor.
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Chapter One: Introduction

Introduction

Humor can mean different things to different people. What one person finds humorous might prove boring or even distasteful to another. However, when one experiences humor, it can be agreed that a very good feeling or affect is produced. It seems obvious, if only from the fact that people seek out exposure to comedians and generally prefer to be with people who have a good sense of humor, that humor is something good and desirable.

Researchers and lay people alike recognize the power of humor. Humor has been shown to be related to positive mood states (Mannell & McMahon, 1982; Lefcourt & Martin, 1986). Further, humor has been proven to have beneficial effects on health (Dillon et al., 1985), hope (Fry, 1987), relaxation (Prerost & Ruma, 1987), learning (Ziv, 1988), and academic task performance (Laurence & Siegel, 1984).

Only in the last forty years have researchers provided evidence that various emotional states could impact people's health (Haig, 1988). Since the end of the Second World War, westerners have been examining such mind-body connections. The field of psychoneuroimmunology - the study of the complex interactions among the nervous system, the endocrine system, and the immune system - was born from the discovery that the brain can influence the immune system. Researchers have uncovered a link between stress and conditions like ulcerative colitis, heart disease, and even some forms of cancer (Shanahan, 1993; Denoillet, 1996; Furman-Haran, & Margalit, 1996). The antithesis of
that laughter, relaxation, or joy could have therapeutic benefits, not to mention
performance benefits - has only recently been seriously considered.

Medical researchers at a dozen or more medical centers have been investigating the
effects of laughter and, more generally, humor, on the human body (Cousins, 1989).
Admittedly, laughter does not always follow humor, but when laughter is present it is
almost always due to humor. A wide array of beneficial changes have been documented -
from enhanced respiration to increases in the number of disease-fighting immune cells.
Dillon et al. (1985) concluded that positive moods activated by laughter or a sense of
humor are associated with elevations in S-IgA concentrations. S-IgA is often regarded as
the body's first line of defense and is thought to defend against viral and bacterial
infections, especially of the upper respiratory tract (Tomasi, 1976). S-IgA concentrations
increased following the presentation of humorous tapes, whereas S-IgA levels remained
stable in control conditions. Similarly, McClelland, Ross, and Patel (1985) reported that
humor improved subjects' immunocompetence. Furthermore, subjects who reported using
humor as a consistent coping mechanism also had the highest initial levels of salivary
immunoglobin A, which suggests that humor may play a role in maintaining the immune
system.

The literature on the physiological effects of humor and laughter is perhaps best
summarized by Siegel (1986):

According to some scientific studies, laughter also increases the production of a class
of brain chemicals called catecholamines. These include the compounds that, in some
circumstances, stimulate the fight-or-flight response, which may inhibit healing.
However, increased amounts of some of these compounds in the blood can also reduce inflammation by activating a different part of the immune system. In addition, they increase the production of endorphins, the body's natural opiates. Thus humor may relieve pain directly, by physiological means, as well as by diverting our attention and helping us relax (p. 144).

In addition to physiological changes, humor has been shown to be associated with positive psychological or mood states in the body as well. Lefcourt and Martin (1986) found humor to positively correlate with positive affect (vigor) while Mannell and McMahon (1982) found humor to negatively correlate with negative affect (anxiety, fatigue, and hostility). Fry and Salmeh (1987) reported that humor provides hope. Along the same lines, Nezu, Nezu, and Blissett (1988) discovered that subjects with a good sense of humor reported lower Beck Depression Inventory scores than individuals with a poor sense of humor. Humor and laughter may be beneficial in depression reduction through "rapid perceptual-cognitive switches in frames of reference" (O'Connell, 1976, p.327).

Svebak (1974) studied the appreciation of humor in terms of hemispheric dominance through electro-physiological studies of brain activity. His data indicated that laughter stimulated both hemispheres of the brain at the same time, coordinating all the senses and producing a unique level of consciousness and a high level mode of brain processing. The brain is essentially operating at its fullest capacity when the right and left brain function simultaneously.

With respect to psychotherapy, the optimally functioning brain affords the client
the ability to see both the logical, concrete, and the abstract or subtle nuances of the problem - thus having therapeutic value. In fact, Salameh (1983) noted that many clinicians include humor in their therapeutic procedures. Furthermore, numerous empirical studies provide evidence that the use of humor may be a highly effective tool in psychotherapy (Fry & Salameh, 1987).

Humor, among other things, can improve perspective (Haig, 1988). Haig reported that the sick individual often sees no alternatives. The author stated that "humor involves a different frame of reference, a juxtaposition of a previously held belief, and a detached objectivity for a brief moment" (p. 171). Humor refers to an overall attitude toward the human condition in which a perspective broader than the circumstances is brought to bear. As Rollo May (1953) noted about humor:

It is an expression of our uniquely human capacity to experience ourselves as subjects who are not swallowed up in the objective situation. It is the healthy way of feeling a "distance" between oneself and the problem, a way of standing off and looking at one's problems with perspective. One cannot laugh when in an anxiety panic, for then one is swallowed up, one has lost the distinction between himself as subject and the objective world around him (p. 54).

Presumably, it is precisely this 'distance' May speaks of that will enable sport participants to better cope with their endeavors and perform more effectively. Athletes compete in stressful environments in which the objective is to overcome adversity and emerge victorious. Byung and Kee-Woong (1984) found that lower levels of anxiety can lead to improved sport performance. Humor is thought to remove situational anxiety and
instill a relaxed (Siegel, 1986), flexible (Svebak, 1974), and hopeful (Fry & Salameh, 1987) state of mind conducive to achieving muscle relaxation - all of which can be crucial to sport performance (Meyers, Schleser, & Okwumabua, 1982; Curry, Snyder, Cook, Ruby, & Rehm, in press).

Humor has been proven to enhance academic task performance (Laurence & Siegel, 1984; Schiller, 1985; Ziv, 1988). Hibbs (1995) attempted to prove a link between humor and both state anxiety and athletic performance by teaching beginning riflery students with humorous methods. However, the hypothesis that a humorous teaching method would reduce state anxiety and enhance performance was not supported, possibly due to experimental procedures, sample size, or other research limitations.

It seems logical that if humor positively affects the aforementioned variables (such as health, affect, relaxation, and level of brain functioning), humor irrespective of the athletic task will positively impact athletic performance.

Statement of the Problem

The purpose of this study is three-fold:

1) To determine differences in competitive varsity men and women tennis players' performance of a skills test among the introduction of a stimuli widely regarded as humorous and two other conditions: introduction of a neutral stimulus and no stimulus.

2) To determine differences in athletes' state affect as a result of the introduction of a humorous stimuli and the other two conditions: introducing a neutral stimulus and no stimulus.
3) To determine differences in athletes' state hope as a result of the introduction of a humorous stimuli and the other two conditions: introduction of a neutral stimulus and no stimulus.

Statement of the Subproblems

There are no subproblems in this study.

Research Hypotheses

1) When men and women subjects watch a humorous videotape, they will score higher on the Tennis Forehand and Backhand Drive Test than when they watch the neutral videotape or no videotape. Also, after viewing the humorous videotape, female subjects will outscore male subjects.

2) There will be no differences in pretest state affect (positive feelings, negative feelings) across the three conditions. However, when subjects watch the humorous videotape, they will show a significant improvement in state affect (higher positive affect, lower negative affect) from pretest to posttest. Also, when subjects watch either the neutral videotape or no videotape, there will be no difference in pretest state affect and posttest state affect.

3) There will be no differences in pretest state hope for the subjects across the three conditions. However, when subjects watch the humorous videotape, they will show a significant improvement in state hope from pretest to posttest. When subjects watch either the neutral videotape or no videotape, there will be no differences in pretest state
Significance of the Study

Athletes and coaches are always searching for ways to improve sport performance. This study will help determine whether humor may significantly augment the pre-performance routine of athletes, particularly tennis players, prior to competition in order to enhance their performance or increase the chances of experiencing a favorable outcome.

Rationale of the Study

The researcher wishes to investigate if the mechanisms by which humor may positively affect the aforementioned variables can transfer into an athletic setting. Since virtually no research has been conducted to measure the effect of humor on well-practiced athletic skills or psychological performance variables, this study shall be considered a preliminary investigation into the effects of humor on athletic skill performance.

Limitations of the Study

The limitations of this study include the following:

1) It is assumed that the subjects responded in a truthful manner

2) It is assumed that the subjects will perform up to their capabilities on the skills tests.

3) There is error inherent in all instrumentation. However, all precautions to keep...
the error level low will be taken.

Delimitations of the Study

The delimitations of this study include the following:

1) The study's primary delimitation is that the main variable under consideration is a score on the Tennis Forehand and Backhand Drive Test, which is not a direct measure of performance. Therefore, results must cautiously be generalized to actual measures of performance.

2) The sample size is small and subjects were selected from a very specific pool of subjects, the University of Montana mens and womens tennis teams (a non-random sample). All were college-age men and women working on their bachelor's degree. This may limit the generalizability of the findings to only tennis players at the college level (no other sport, age group, education level, or ability level). Also, this delimitation may reduce the possibility of generalizing to larger schools (+20,000 students).

3) The subjects watched the two experimental conditions via a videorecording; they did not listen to them via an audiotape. In the interest of external validity, audiotape is a much more practical and viable option for athletes to use than is videotape.

Definition of Terms

1) **Humor:** 1. funny quality; 2. the ability to find fun and amusement in things (Hoppenstedt, 1991).
2) **Sense of Humor:** 1. the ability to see a joke, or to see and state the amusing side of things; 2. state of mind; mood; temperament (Hoppenstedt, 1991).

3) **Perspective:** 1. the capacity to view things in their true relations or relative importance. 2. a visible scene; especially one giving a distinctive impression of distance. 3. a mental view or prospect (Hoppenstedt, 1991).

4) **Skill:** dexterity or coordination especially in the execution of learned physical tasks (Merriam-Webster's Collegiate Dictionary, 1986).

5) **Performance:** the execution of an action (Merriam-Webster's Collegiate Dictionary, 1986).

6) **Mood:** Positive Affect: a reflection of the extent to which a person feels enthusiastic, active, and alert (Watson, Clark, & Tellegen, 1988).

   Negative Affect: a general dimension of subjective distress and unpleasurable engagement that subsumes a variety of aversive mood states, including anger, contempt, disgust, guilt, fear, and nervousness (Watson, Clark, & Tellegen, 1988).

7) **State Hope:** a positive motivational state in the present tense that is based on an interactively derived sense of successful (a) agency (goal-directed energy), and (b) pathways (planning to meet goals) (Snyder & Sympson, 1996).
Chapter Two: Review of Literature

Introduction

In general, there is little empirical research to support the numerous claims that humor offers a positive influence on mental and physical health (Goldstein, 1987). Haig (1988) stated that "the actual connection between humor and healing remains rather sketchy, but testimonies, case histories, and a growing belief in mind-body interactions warrant further research." However, there has been recent research on the effects of humor on creativity, learning, anxiety, depression, and sickness.

Perhaps one of the most publicized authors in the field of humor was Norman Cousins. Cousins contended that humor provides the "apothecary inside you." Likening laughter to "internal jogging," Cousins believed laughter has a positive effect on blood pressure, oxygenating the blood, massaging vital organs, facilitating diaphragm stimulation, and causing the natural release of endorphins - the body's natural pain killers.

Cousins also claimed first-hand anecdotal evidence of the healing power of humor. The long-time editor of the Saturday Review and former adjunct professor at the UCLA School of Medicine was given slim chance of recovering from ankylosing spondylitis, a rare connective tissue disease attacking his joints. In response to acute pain and a worsening condition, Cousins treated his illness by watching humorous films and programs such as various Laurel and Hardy movies and episodes from "Candid Camera." Eventually, Cousins enjoyed a complete recovery from the disorder, which was thought to be a fatal disorder. In 1989 he wrote:
Obviously, what worked for me may not work for everyone else. Accumulating research points to a connection between laughter and immune enhancement, but it would be an error and indeed irresponsible to suggest that laughter - or the positive emotions in general - have universal or automatic validity, whatever the circumstances. People respond differently to the same things. One man’s humor is another man’s ho-hum. The treatment of illness has to be carefully tailored to suit the individual patient.

To be sure, laughter may not always be caused by humor. For example, members of Bombay, India’s twenty-eight “laughing clubs” don’t laugh at anything in particular. They simply believe in the inherent power of laughter itself. In terms of physiology, Fry and Salameh (1987) found hard laughter to increase heart rate, breathing, and oxygen consumption - an exercise-like response. Relaxation soon follows. Specifically, laughter benefits the autonomic system by promoting protective responses of the immune system and by initially stimulating, then depressing, arousal. Likewise, laughter initially stimulates, then depresses, muscle tension, which reduces muscle-related pains. Laughter also ameliorates sensitivity to pain (Cogan, Cogan, Waltz, & McCue, 1987; Hudak, Dale, Hudak, & DeGood, 1991).

Similarly, Prerost and Ruma (1987) determined that subjects exposed to cartoons eliciting a humor response showed a significant decrease in muscle tension. Compared to the level of muscle tension present before exposure to the cartoons, the subjects experienced a rapid release of tenseness following enjoyment of the humorous stimuli. Indeed, relaxation training (in conjunction with biofeedback techniques) has been found useful in dealing with sport performance anxiety (Meyers, Schleser, & Okwumabua,
1982). Moreover, lower levels of anxiety (Byung & Kee-Woong, 1984) and relaxation
(Weinberg, Chan, and Jackson, 1983) can lead to improved sport performance. Morgan's
research (1979) on the so-called "iceberg profile" strongly supports the notion that it be
desirable for an athlete to have a high level of positive feelings and a low level of negative
feelings. According to Morgan, elite world-class athletes, in general, display mood state
scores high in vigor but low in tension, depression, anger, fatigue, and confusion.

Besides removing situational anxiety, Prerost and Ruma (1987) reported that
subjects who received humor reported a positive affective state (to include relaxation)
following exposure to humorous cartoons. In the same study, on mood measures
(Nowlis-Green Mood Adjective Checklist) administered after the relaxation experience,
subjects exposed to humor reported elation and vigor. Subjects in the control group who
viewed forest scenery and who did not receive the humorous stimuli reported a sense of
fatigue following relaxation.

Mannell and McMahon (1982) also found positive mood states to be related to
humor. Mannell and McMahon found a positive correlation between noting the number of
humorous incidents and the frequency of overt laughter and a negative correlation with
anxiety, fatigue, and hostility on the Nowlis Green Mood Adjective Checklist. Likewise,
Lefcourt and Martin (1986) have repeatedly found humor scales positively correlated with
the Vigor subscale of the Profile of Mood States (POMS). Although positive affect states
may occur without any incident of humor, humor may often be a correlate of positive
affect. Humor is therefore thought to remove situational anxiety and instill a relaxed,
flexible, and hopeful state of mind conducive to achieving muscle relaxation - all of which
can be crucial to sport performance.

An athletic contest can produce a very stressful environment. In stressful situations, Martin and Lefcourt (1983) found that certain types of humor can serve as a buffer to diminish the deleterious impacts of an experience. A major characteristic of humor appears to be a defense against threat to gain control over perceived or actual uncontrollable events (Thorson, 1985). In addition, humor appears to relieve the heightened arousal associated with anticipation of a negative experience (Shurcliff, 1968). Yovetich, Dale, and Hudak (1990) reported that subjects from a humor condition consistently rated themselves as less anxious and reported less increase in stress as the threat of an electric shock approached. Humor apparently reduced subjects' anxiety more effectively than did a mere distraction or no distraction.

A negative interpretation of a stressful event can increase anxiety, which, in turn, can increase pain and discomfort; in contrast, relaxation tends to decrease pain and discomfort (Elton, Stanley, & Burrows, 1983). Freud (1960) himself acknowledged humor as an adaptive coping mechanism. Martin and Lefcourt (1984) found that a sense of humor may be a primary personality variable associated with effective coping ability. In fact, Hudak et al. (1991) determined that, compared to subjects in a nonhumorous condition, subjects in a humorous condition experienced a significant increase in discomfort threshold in response to a Transcutaneous End Nerve Stimulation (TENS). Cogan et al. (1987) reported a similar increase in discomfort threshold following a laughter-inducing condition.
High Humor and Low Humor

In the same way that Martin and Lefcourt (1984) found humor to moderate the mood effects of stressful experiences, Martin and Dobbin (1988) found evidence that humor serves to moderate the physiological effects of stress: Those who had a lesser sense of humor showed the greatest immunosuppressive effect following the experience of negative life events while those with a good sense of humor, comparatively, seemed to be less predictable from measures of stressful experiences. Similarly, a study on humor's effect on longevity showed that senior citizens who had outlived their siblings by an average of seven years rated their own sense of humor as better than the brother or sister that had died (Yoder & Haude, 1995). Lefcourt and Davidson-Katz (1991) state that it seems as though people with a good sense of humor are less likely to passively accept the negative affects that accompany stressful experiences. Humor seems to signify an active and assertive orientation that augurs a readiness to change feelings and, perhaps, an impatience with negative affects such as anxiety and depression (p. 49).

Apparently, the person with a good sense of humor does not as easily accept the experiencing of negative emotions for a lengthy time as might a person with a less mirthful disposition. In general, subjects high in humor deal with stress better than those low in humor (Martin & Lefcourt, 1983; Schill & O'Laughlin, 1984; Nezu, Nezu, & Blissett, 1988; Yovetich, Dale, & Hudak, 1990). Because anxiety is an extremely common trait among competitive athletes, it follows that those athletes who encounter a humorous stimuli and are labeled as "high" in humor may deal with stress better than those
encountering a humorous stimuli and labeled as "low" in humor. For example, many would agree that Jimmy Connors has a good sense of humor, at least on the tennis court. This trait may have contributed to his remarkably successful tennis career. A good sense of humor could lead to relaxation and lower levels of anxiety, which have been proven to improve sport performance (Byung, & Kee-Woong, 1984; Weinberg, Chan, & Jackson, 1983).

Gender and Perception of Humor

The research on how men and women differ in their perception of humor is somewhat ambiguous. Ziv (1984) concluded that, in general, women were more appreciative of humor than men, but the converse was the case when considering the creation of humor. One explanation for this was that many jokes have aggressive or sexual components which females have traditionally been discouraged from expressing openly; thus, they did not tell such jokes.

Gorham and Christophel (1990) also found that male and female students perceive humor differently and that the effects of humor on learning differ by student gender. Female students' learning outcomes did not appear to be as strongly influenced by teacher humor as were male students' outcomes, although the use of stories or anecdotes, particularly personal stories related to the lecture topic, seem to have been favored by females. Male students listed proportionately more tendentious comments as things their teachers did "to show he/she has a sense of humor," suggesting that they were more likely to attend to and perceive such comments as humorous even though too great a
dependence on them diminished affect. In addition, students appeared to be more strongly influenced by the amount and type of humor used by male teachers than by female teachers.

Svebak (1974) also showed that men and women respond differently to humor. He found that males were strongly committed to the social context and modified their laughter in accordance with their conceptions of social roles, while females regulated laughter more in accordance with their emotional state. This is in agreement with the finding that females are more emotionally expressive than males.

Finally, female subjects who were exposed to humorous stimuli in the form of cartoons and then instructed to relax reported higher levels of both vigor and elation at the conclusion of relaxation than did male subjects (Prerost & Ruma, 1987).

Learning, Problem-Solving, and Task Performance

Positive affect such as that which can be generated by humor seems to be associated with more flexibility and/or ingenuity in problem-solving. Isen, Daubman, and Nowicki (1987) found that subjects from a group in which positive affect was induced by humor or the receipt of small gifts exhibited improved performance (produced significantly more solutions) on two tasks requiring creative ingenuity for their solution: Duncker's Candle Task and the Remote Associates Test. It is hypothesized that humor relaxes the individual and allows him/her to think of many different solutions to a problem. A broad outlook such as this may be very beneficial on the playing field where mental flexibility in decision making is just as important as physical flexibility.
Cartoons have been popular among researchers wishing to subject individuals to humorous stimuli. Sadowski, Golgoz, and Lobello (1994) showed cartoons that were relevant to class lecture material to university students. Compared to the subjects who saw no humorous cartoons but received the same lecture, those who received the cartoon examples did better (55% passing rate on the examination compared to 33% passing rate).

Similarly, Ziv (1988) reported that Israeli college students who were taught with the aid of humor (n=161) performed significantly better on examinations than those Israeli students taught without humor (n=132). Schiller (1985) investigated the effects of humor on the performance of college freshmen on the Nelson Denny Reading Post Test. She used three groups of subjects: One group received a humorous article entitled "Turds" to read before taking the test; one group received a neutral article entitled "Sinkholes" before taking the test; and one group received no article prior to taking the test. Results indicated that the students who read the humorous article did significantly better on the test than the control group and the neutral group. Finally, Laurence and Siegel (1984) also showed that humor improved the level of academic task performance. The study involved forty college students who completed a mathematics test under one of four experimental conditions: high or moderate stress, presence or absence of humor. The procedure involved a pretest administration of the stressor (the Quiz Electrocardiogram) combined with the math test (the dependent variable).

The only research attempting to show a link between humor and athletic performance failed to produce significant findings. Hibbs (1995) used two experimental groups and one control group. The first experimental group, beginning riflery students,
received instruction in a non-humorous manner. The second experimental group, also
beginning riflery students, received instruction which was delivered with humorous
illustrations, smiling, and jokes. The control group was composed of experienced
shooters; they received no instruction. The hypothesis that the experimental group
receiving humorous instruction would perform better than the experimental group
receiving non-humorous instruction was not supported. A possible explanation for the
"entertained" experimental group's failure to outperform the "non-entertained"
experimental group lies in the dependent variable. Perhaps a subject must reach a certain
degree of proficiency in the skill being measured before humor can enhance their
performance.

Interestingly, it appears that humor does play a role in the athletes' perceptions of
their coaches' abilities and the liking of their coaches. Burke, Peterson, and Nix (1995)
reported a low to moderate relationship (r=.379) between the coaches' sense of humor and
coaching ability, a moderate relationship (r=.567) between the coaches' sense of humor
and liking of the coaches by the players, and a strong relationship (r=.782) between liking
the coaches and the rating of the coaches' abilities by the players. The researchers
concluded their findings by stating that "sport psychologists may wish to incorporate
humor as a part of their intervention strategies in the assistance of athletes, as well as,
promote its use with and among coaches."
Chapter Three: Methods and Procedures

Participants

Subjects were thirteen 18-21 year old Caucasian members of the University of Montana tennis teams (5 female, 8 male). Prior to the study, all subjects signed an informed consent form (see Appendix I). All aspects of this research were approved by the University of Montana Institutional Review Board.

Instrumentation

Humorous Videotape: Taped from "Saturday Night Live," January, 1997. Approximately thirteen minutes of videotape featuring Jim Carrey in two skits of approximately equal length. The first skit involved Jim Carrey and two other actors, a female and a male. All three comedians imitate high school cheerleaders. The second skit involved Jim Carrey and two other male actors. Jim Carrey's character is a lifeguard overseeing the occupants of a jacuzzi. An undergraduate audience of about fifty students prescreened various material and chose the above skits.

Neutral Videotape: "How Clouds are Formed," 1979. Fifteen minutes of instructional videotape on the process of cloud formation. Discussion includes the role of temperature, humidity, and air pressure. The experimenter chose the video based on previous humor research using neutral videotapes on such subjects as flowers and geology.
The Brief Assessment of Mood (BAM) (Whelan & Meyers, manuscript): This six-item version of the Profile of Mood States (POMS) has been proven to be an efficient measure of immediate mood state. Reliability of the BAM was established through high correlations (.88, .69) between it and the POMS and similar internal consistency values for the two measures when administered to a large sample of undergraduates. The validity of the BAM was supported when it matched the POMS' sensitivity to high school runners' post-race evaluations of their performance. Rather than utilize the POMS, the investigator chose the BAM in order to capture the immediate emotional response to the video interventions. Weckowicz (as cited in Whelan & Meyers), has argued that the temporal stability of the POMS indicated a lack of sensitivity to rapidly changing emotional status. The POMS takes approximately five minutes to complete while the BAM can be completed in approximately thirty seconds.

The State Hope Scale (Snyder, Sympson, Ybasco, Borders, Babyak, Higgins, 1996): Based on the twelve-item dispositional or Trait Hope Scale, this six-item scale measures one's current level of goal-directed thinking or hope. Specifically, Snyder and colleagues (1991) have defined hope as "a cognitive set that is based on a reciprocally derived sense of successful agency (goal-directed determination) and pathways (planning to meet goals)" (p. 321). The scale contains three agency items and three pathway items reworded from the Trait Hope Scale so as to capture the present tense (e.g., two agency items are "At the present time, I am energetically pursuing my goals," and "At this time, I am meeting the goals that I have set for myself"; two pathway items are "There are lots of ways around any problem that I am facing now," and "I can think of many ways to reach
my current goals."). Participants are asked to select the number (from 1 = definitely false
to 8 = definitely true) that best describes "how you think about yourself right now." The
total State Hope score is the sum of the six item scores. Higher scores indicate higher
hope; lower scores indicate lower hope. The State Hope Scale has high internal reliability
(median Cronbach alpha = .93) as well as concurrent validity in relation to other related
state measures. For example, State Hope scores have related positively to ongoing state
self-esteem and positive affect and they have related negatively to negative affect. Finally,
the State Hope Scale's discriminant utility is sensitive enough to reflect the variability in
level of hope at particular points in time, and it does so beyond projections due to other
state indices. Furthermore, Curry et al. (in press) reported a positive correlation of state
hope scores and both intellectual and motor skill performance. In other words, persons
who report an ongoing state level of hope that is elevated also are likely to perform well
on performance tasks related to cognitive and physical skills.

Tennis Forehand and Backhand Drive Test (Purcell, 1981): The objective of the
Forehand and Backhand Drive Test is to measure tennis ability which would closely
resemble the actual game situation. The test "should be effective for assessing skill of
males and females of various ages and abilities" (p. 245). The forehand and backhand
drives constitute the vast majority of shots used in a game of tennis. The factors of
importance in assessing the effectiveness of forehand and backhand drives are speed,
direction, and depth. The test evaluates depth and direction by rewarding the student
more for shots directed deep to the center of the court while penalizing the student for
being short, long, or wide of the target area. Speed is considered by measuring the time
required for the ball to travel from the racquet to the target. After a brief warm-up, each subject takes, in succession, two administrations of the test. Each test consists of a subject returning ten forehands and then ten backhands from balls pitched by a ball machine into areas drawn in chalk on a regulation tennis court. (The subject's skills test score after each intervention is comprised of the sum of the average forehand score from the two tests and the average backhand score from the two tests.) The speed of the subject's shots is assessed by measuring accumulated time in flight for rounds of ten trials using a stopwatch. A time factor is used to correct the target value total for the trials to adjust for ball speed, thereby rewarding the more skilled player who can strike the ball more firmly while still retaining control. High scores reflect high skill levels whereas low scores reflect low skill levels. The test-retest reliability of the test was found to be .84, while the validity of the test, using judges' ratings of a criterion, was .83. This test has a notable advantage over most other tennis skills tests because it utilizes a testing protocol that is quite similar to the actual game situation and because of its ability to evaluate tennis skill by considering both ball control and velocity.

"Matchmate" Tennis Ball Machine: With this ball machine, the experimenter could control the speed and angle of the pitched balls.

Procedure

In April of the spring semester, 1997, the experimenter began data collection. All but one of the subjects had finished competing for the season. He explained each aspect of the procedure to each subject as they underwent testing. In hope of raising the anxiety
level of the subjects in order to better gauge the effects of the humorous stimuli, he informed the subjects, individually, that the head tennis coach would be aware of their skills test scores.

The experimenter administered both pre- and posttests of two paper and pencil state measures, the Brief Assessment of Mood (BAM) and the State Hope Scale. Pretests were utilized in order to assess initial state affect and initial state level of hope while posttests reflected the effects of each of the interventions from the pretest baseline. In addition, the subjects were asked to evaluate the humorous videotape in terms of how humorous they found it and to indicate how many times they laughed. Between the pretests and the posttests, each subject was exposed to one of three interventions: the control condition (no videotape) or to one of the two treatment conditions (neutral videotape, humorous videotape). The neutral condition was employed in order to rule out humor as a mere distraction. Though each subject received only one of the three interventions per day, each subject was exposed to all three interventions throughout the course of data collection. Subjects were blind to the intervention they were assigned during a session.

The experimenter requested that the subjects not to discuss between themselves the content of the two videotapes. At the end of each intervention, each subject participated in a standardized tennis skills test - the Forehand and Backhand Drive Test. The experimenter asked the subjects not to talk to anyone between the end of the intervention and the beginning of the skills test.
The following timeline illustrates the data collection process:

<table>
<thead>
<tr>
<th>2 mins.</th>
<th>15 mins.</th>
<th>2 mins.</th>
<th>5 mins.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

pretest: no videotape
BAM, 
Hope neutral videotape
Scale humorous videotape

posttest: Tennis Forehand
BAM, 
Hope Backhand 
Scale Drive Test

With this design, each subject completed experimentation for the day in about thirty minutes.

The experimenter administered the surveys and interventions. In addition, the experimenter recorded the times of each subject's trial (e.g.: 1.27 seconds) while an assistant told the experimenter the target values (e.g.: "6") of each trial. The experimenter administered the skills test, which included explaining the test, setting up the ball machine, and marking the court.

Before data collection, each subject received a subject number (2-14) which represented that subject throughout the experiment. The three conditions were linked to nickels marked with different years.
For example, Monday, March 24:

1975
1976 Condition 1: No Videotape
1977

1978
1979 Condition 2: Neutral Videotape
1980

1981
1982 Condition 3: Humorous Videotape
1983

A coin was drawn for each subject in order to determine which intervention that subject would receive for the day. The coins were replaced after being drawn. For example, Monday, March 24:

1st coin drawn is for Subject # 3: 1978 = Condition 2: Neutral Videotape
2nd coin drawn is for Subject# 6: 1983 = Condition 3: Humorous Videotape
3rd coin drawn is for Subject # 7: 1978 = Condition 2: Neutral Videotape
4th coin drawn is for Subject # 9: 1977 = Condition 1: No Videotape
5th coin drawn is for Subject #10: 1982 = Condition 3: Humorous Videotape
6th coin drawn is for Subject #11: 1981 = Condition 3: Humorous Videotape
7th coin drawn is for Subject #13: 1977 = Condition 1: No Videotape
8th coin drawn is for Subject #14: 1976 = Condition 1: No Videotape

The subjects proceeded one at a time through each phase of experimentation.

The subjects took the surveys and were exposed to the two videotape conditions
and the "no videotape" condition while seated quietly in a room in McGill Hall located about eighty yards from the skills test site. The "no videotape" condition consisted of the subject sitting in a chair beside a television that was off. After being exposed to one of the three conditions and completing the paper and pencil tests, the subject walked to the tennis court - usually within four minutes of the end of the intervention. There, the experimenter explained the rules of the test and testing commenced. The subject began by hitting several practice tennis balls as dictated by the tennis skills test.

The same testing format continued until each subject was exposed to each of the three conditions. Data collection took nine days to complete.
Chapter Four: Results

All thirteen subjects completed the protocol as described earlier.

Table 1 indicates the extent to which the subjects enjoyed the humorous video.

Table 1
Subjects' Appraisal of Humor Condition by Gender

<table>
<thead>
<tr>
<th>Gender</th>
<th>Mean Rating</th>
<th>Self-Report of # of Times Laughing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Females</td>
<td>4.2000</td>
<td>6.8000</td>
</tr>
<tr>
<td>Males</td>
<td>3.8571</td>
<td>3.1429</td>
</tr>
</tbody>
</table>

Females rated the humorous video as being funnier (4.2 on a scale of 1-5, with 5 being the funniest) than did the males (3.8571). Similarly, females laughed more than twice as much (6.8) as men (3.1429) during the humorous video (p=.104).

Hypothesis One

It was hypothesized that when men and women subjects watch a humorous videotape, they will score higher on the Tennis Forehand and Backhand Drive Test than when they watch the neutral videotape or no videotape. Also, after watching the humorous videotape, it was hypothesized that female subjects will outscore male subjects.
Table 2 indicates how the subjects scored after each of the three conditions.

### Table 2

<table>
<thead>
<tr>
<th>Condition</th>
<th>Relaxation</th>
<th>Neutral</th>
<th>Humor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Females</td>
<td>135.03</td>
<td>140.86</td>
<td>142.54</td>
</tr>
<tr>
<td>Males</td>
<td>139.86</td>
<td>141.05</td>
<td>139.02</td>
</tr>
</tbody>
</table>

A 2 (male, female) X 3 (skills test score after T1, skills test score after T2, skills test score after T3) mixed design repeated measures ANOVA at the p = .05 level of significance was conducted in order to determine performance differences on the tennis skills test by gender in each of the three interventions (no videotape = T1, neutral videotape = T2, humorous videotape = T3).

No significant interaction between condition and gender was found (p=.892). There were also no significant main effects for condition (p=.903) or gender (p=.945). Though not significant, the women did outscore the men after watching the humorous video. Therefore, the hypothesis was not supported.

**Hypothesis Two**

It was hypothesized that there will be no differences in pretest state affect (positive feelings, negative feelings) across the three conditions. However, when subjects watch the humorous videotape, it was hypothesized that they will show a significant improvement in
state affect (higher positive affect, lower negative affect) from pretest to posttest. Also, when subjects watch either the neutral videotape or no videotape, it was hypothesized that there will be no difference in pretest state affect and posttest state affect.

Table 3 reflects the subjects' average positive and negative affect scores.

Table 3

<table>
<thead>
<tr>
<th></th>
<th>Relaxation Condition: Average BAM</th>
<th>Neutral Condition: Average BAM</th>
<th>Humor Condition: Average BAM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-Positive</td>
<td>Post-Positive</td>
<td>Pre-Negative</td>
</tr>
</tbody>
</table>

* indicates significance (p=.05)
One independent 2 (male, female) X 3 (levels of positive feelings prior to T1, T2, T3) mixed design repeated measures ANOVA and one independent 2 (male, female) X 3 (levels of negative feelings prior to T1, T2, T3) mixed design repeated measures ANOVA were conducted at the .05 level of significance in order to determine differences in pretest levels of state affect by condition and gender. For the pretest levels of positive feelings, no significant interaction between condition and gender was found (p=.563). There were also no significant main effects for condition (p=.791) or gender (p=.777).

For the pretest levels of negative feelings, no significant interaction between condition and gender was found (p=.383). Also, there was no significant main effect for condition (p=.202). Within the humor condition, however, the females came into the condition with a significantly lower level of negative affect than the males (p=.046). In addition, the main effect of gender was significant (p=.009); males reported higher levels of pretest negative affect. The mean for females was 7.8 while the mean for males was 9.6.

In addition, one independent 2 (male, female) X 3 (difference in positive state affect due to T1, T2, T3) mixed design repeated measures ANOVA and one independent 2 (male, female) X 3 (difference in negative state affect due to T1, T2, T3) mixed design repeated measures ANOVA were conducted at the .05 level of significance in order to determine differences, by gender and condition, in pretest and posttest levels of positive feelings and pretest and posttest levels of negative feelings.

For the difference between posttest levels of positive feelings and pretest levels of
positive feelings, no significant interaction was found between condition and gender (p=.581). There were also no significant main effects for condition (p=.471) or gender (p=.375). However, the drop in females’ level positive feelings between pretest and posttest scores during the neutral condition approached significance (p=.08).

For the difference between posttest levels of negative feelings and pretest levels of negative feelings, no significant interaction between condition and gender was found (p=.204). Also, there were no significant main effects for condition (p=.884) or gender (p=.862). For the neutral condition, the men’s level of negative feelings decreased, and this decline approached significance (p=.051). However, the humor condition is the only condition which showed a decrease in negative affect for both sexes, and this drop approached significance (p=.071). In fact, the women’s level of negative feelings decreased significantly (p=.016) after watching the humorous video.

Therefore, for the most part, this hypothesis was not supported. However, females did record significantly lower levels of negative feelings prior to the three conditions (p=.009) than did males.

**Hypothesis Three**

It was hypothesized that there will be no differences in pretest state hope for the subjects across the three conditions. However, it was hypothesized that when subjects watch the humorous videotape, they will show a significant improvement in state hope from pretest to posttest. Finally, it was hypothesized that when subjects watch either the neutral videotape or no videotape, there will be no differences in pretest state hope and
A posttest state hope.

Table 4 illustrates the subjects' average state hope scores.

Table 4
State Levels of Hope by Gender and Condition

<table>
<thead>
<tr>
<th></th>
<th>Relaxation Condition: Average Hope</th>
<th>Neutral Condition: Average Hope</th>
<th>Humor Condition: Average Hope</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre</td>
<td>Post</td>
<td>Pre</td>
</tr>
<tr>
<td>Female</td>
<td>42.40*</td>
<td>43.00*</td>
<td>43.20*</td>
</tr>
<tr>
<td>Male</td>
<td>39.75</td>
<td>38.25</td>
<td>38.00</td>
</tr>
</tbody>
</table>

* indicates significance (p=.05)

A independent 2 (male, female) X 3 (levels of state hope prior to T1, T2, and T3) mixed design repeated measures ANOVA at the .05 level of significance was conducted in order to determine differences in pretest state hope levels by gender and condition across the three interventions. There was no significant interaction between condition and gender (p=.482). There was also no significant main effect for condition (p=.878), but the main
effect of gender was significant (p=.013). With a mean of 42.6, females' pretest state hope level was higher than the males' level (39.4).

A 2 (male, female) X 3 (differences in state hope due to T1, T2, T3) mixed design repeated measures ANOVA was also conducted at the .05 level of significance in order to determine differences by gender and condition in pretest levels of state hope and posttest levels of state hope. No significant interaction was found (p=.658). There were also no significant main effects for condition (p=.509) or gender (p=.188).

Gender

There were no significant differences between pretest and posttest state hope scores for either gender across the three conditions. On the whole, women came into each of the three conditions at a higher level of state hope than the men (p=.013), and they also had higher posttest scores for each of the three conditions (p=.005).

Condition

Following the humor condition, both genders reported an increase in state hope that approached significance (p=.111). For the neutral condition, females reported higher state hope scores than did males for both the pretest (p=.034) and the posttest (p=.031). For the relaxation condition, there were no significant differences in pretest and posttest state hope scores.

On the whole, this hypothesis was not supported. However, women did have significantly higher levels of hope (p=.013) prior to the three conditions.
Table 5 indicates both the mean pretest and posttest state hope and state affect scores by condition only (without considering gender).

Table 5
Mean Pretest and Posttest State Hope and State Affect Scores by Condition

<table>
<thead>
<tr>
<th>Variable</th>
<th>Relaxation</th>
<th>Neutral</th>
<th>Humor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hope: Pretest</td>
<td>40.77</td>
<td>40.00</td>
<td>41.15</td>
</tr>
<tr>
<td>Hope: Posttest</td>
<td>40.08</td>
<td>39.46</td>
<td>41.62</td>
</tr>
<tr>
<td>Positive Feelings: Pretest</td>
<td>16.85</td>
<td>15.85</td>
<td>16.54</td>
</tr>
<tr>
<td>Positive Feelings: Posttest</td>
<td>16.00</td>
<td>14.38*</td>
<td>15.92</td>
</tr>
<tr>
<td>Negative Feelings: Pretest</td>
<td>9.54</td>
<td>8.85</td>
<td>8.31</td>
</tr>
<tr>
<td>Negative Feelings: Posttest</td>
<td>9.31</td>
<td>8.31</td>
<td>7.69</td>
</tr>
</tbody>
</table>

* indicates significance (p=.05)

For the relaxation condition, there were no significant findings. There was a higher level of positive feelings before the condition than after the condition, and this change approached significance (p=.051).

For the neutral condition, there was a significantly lower level of positive feelings after the viewing of the clouds video than before (p=.015).

For the humor condition, there were no significant findings. However, the subjects' level of negative feelings decreased after viewing of the humorous video, and this finding approached significance (p=.071).
The purpose of this preliminary study was to examine the effect of a stimuli widely regarded as humorous on collegiate tennis players' performance of a standardized skills test. Though no significant performance data emerged from the project, there were several noteworthy self-report state measures data (hope, affect) recorded both before and after each of the three interventions.

On the whole, the subjects found the humorous "Saturday Night Live" video to be humorous. Consistent with Ziv's research (1984), females found the tape funnier than did the males. The female subjects also laughed more than twice as often as the males, and this difference approached significance (p=.104).

State Hope

Interestingly, females' pretest hope scores were significantly higher than males' pretest scores before one of the three conditions (p=.013). There is no data to support this finding that females have higher state levels of hope than do males (Snyder, Sympson, et al., 1991). Perhaps the women were more optimistic at the time of test administration because only they became aware of something they interpreted as being positive. For example, maybe the women's head coach talked to them about an upcoming schedule of opponents that included teams not ranked as high as they.

The humor condition yielded data that somewhat reflects previous research stating that humor provides hope (Fry & Salameh, 1987). After watching the humorous video,
both genders reported an increase in state hope \((p=.111)\). Though only approaching significance, this increase is worth testing again with a larger sample.

**Positive and Negative State Affect**

Positive affect has been shown to follow exposure to humorous stimuli (Prerost & Ruma, 1987). Further, such positive affect has been associated with improved performance (significantly more solutions) on tasks requiring creative ingenuity for their solution (Isen, et. al, 1987). In addition, Morgan's "iceberg profile" (1979) not only adds support to the benefits of high levels of positive affect but also to the negative aspects of high levels of negative affect.

On the average, women came into each of the conditions reporting a significantly lower level of negative feelings \((p=.009)\). This fact, coupled with their significantly higher levels of pretest hope, leads one to believe that the women were in better spirits than the men. This gender difference could be due to the small sample size. It is also possible that the males had more negative feelings because they were more anxious about outperforming their peers in hope of impressing their male coach.

The relaxation condition was associated with an almost significant drop \((p=.051)\) in subjects' level of positive feelings. Without a prepared relaxation protocol, perhaps the subjects got "carried away" by their own anxiety-producing thoughts and were unable to relax.

The humor condition was the only condition linked to a significant decrease \((p=.016)\) in negative affect for women, supporting Prerost & Ruma (1987).
Possible Reasons for Not Attaining Significance

No difference in mean skills test score was found among the skills tests administered after the three conditions. If humor can indeed positively affect tennis sport performance, one of the biggest reasons as to why significance may have been masked concerns the small sample size of this study (N=13). Further, it is possible that too much time elapsed between the paper and pencil posttests and the skills tests. Also, during this time subjects may have been distracted in some way, such as by seeing a friend on the sidewalk en route to the test site.

Also, the skills test itself may be an inappropriate measure for this experiment. These highly skilled subjects may have found the test monotonous and unlike an actual tennis match. It is also possible that the mental and physical factors that prevent an advanced tennis player from performing better are not positively influenced by humorous stimuli.

It may also be the case that, rather than videotape, audiotape would have been a more effective medium by which to expose the subjects to humor. Audiotape may be better able to physiologically affect the body because one must create mental images as opposed to having them provided, as is the case with videotape. On the other hand, perhaps the humor condition worked too well for some subjects, relaxing them beyond the point of optimal performance.

Implications for Future Research

Future experimentation should involve a larger sample size, perhaps 100% larger
(N=26). The experimenter may wish to target females since humor tends to more favorable affect their mood. Further, as stated earlier, since the ability to affect one’s mood and physiology could lie specifically in laughter and not in the mental appreciation of humor, more investigation into this distinction is recommended. Also, the researcher may wish to choose a sport in which there exists no differences between the testing protocol and the way the sport is played and scored. Rather than testing athletes in a sport which requires open motor skills, the experimenter could opt to use an individual sport involving closed motor skills, such as bowling or shooting. Such sports are recommended primarily because their scores are a much clearer indicator of the athlete’s performance level. Other factors, such as the opponent’s performance level, don’t affect the subject’s score nearly as much. This suggestion is also made in the interest of external validity - if significance is achieved, it will take on greater meaning in comparison to a testing protocol involving merely a skills test.

Along these lines, future research may profit by allowing no more than one minute elapse between the end of the stimulus and the beginning of the performance measure. If humor has any effect on sport performance, it is more than likely time-dependent. Also, future work may also attempt to answer the question, "How long do the effects of humor last?"

To be most effective, both the content of the humorous material and the way in which it is delivered probably needs to be as clean and as direct as possible. Sarcasm, vulgarity, sexual innuendos, and jokes at someone’s expense probably detract from humor’s potential to effect performance gains.
Conclusion

Finally, it has been shown that humor can positively affect health (Dillon et. al, 1985), hope (Fry & Salameh, 1987), mood state (Prerost & Ruma, 1987), relaxation (Prerost & Ruma, 1987), problem-solving (Isen et. al, 1987), and academic task performance (Ziv, 1988). Further, though not supported by this study, because higher levels of hope have been associated with greater motor skill performance (Curry et al., (in press)), and because favorable mood states (low negative affect, high positive affect) have been associated with elite performers (Morgan, 1979), it is imperative that more progress be made to further hone in on the power of humor and its application to sport. Indeed, further research is necessary before any definitive conclusions can be drawn.


Appendix I

Informed Consent Statement

The Department of Health and Human Performance at The University of Montana supports the practice of protection for human subjects participating in research. The following information is provided so that you can decide whether or not you wish to participate in the present study. You should be aware that even if you agree to participate, you are free to withdraw at any time without penalty.

The study is concerned with how humor affects athletes' performance of a tennis skills test. You will be exposed to three experimental conditions: two videos of the same length and a condition that involves you sitting quietly for the same amount of time. You will also be asked to fill out three surveys concerning how you feel about one of the videos and how you feel about yourself at the time you take the surveys. Finally, you will perform a tennis skills test a total of three times. The skills test will consist of you crisply returning balls into various marked "target" areas of the court for points. Experimentation will take a total of 20 minutes per day, and you will be asked to come for 3 days at your convenience. There is minimal chance of injury. Because you are asked to perform to your potential, the skills test may invoke a minimal amount of anxiety which is inherent in any tennis competition.

In the event that you are injured as a result of this research, you should individually seek appropriate medical treatment. If the injury is caused by the negligence of the University or any of its employees, you may be entitled to reimbursement or compensation pursuant to the Comprehensive State Insurance Plan established by the Department of Administration under the authority of M.C.A., Title 2, Chapter 9. In the event of a claim for such injury, further information may be obtained from the University's Claims Representative or University Legal Counsel.

Your participation is solicited, but is strictly voluntary. Be assured that your name will not be associated in any way with the research findings. Only the principal investigator and his supervisor will know individual participants' names. All information will be coded by an identification number. Do not hesitate to ask any questions about this study. If you would like additional information concerning this study before, during, or after it is completed, please feel free to contact us by phone or mail. A copy of this consent form will be given to you.

We appreciate your cooperation and thank you for your participation.

Sincerely,

Chris Bernuth
Principal Investigator
219 McGill/HHP Dept.
The University of Montana
Missoula, MT 59812
(406) 243-5528

Signature of Subject
agreeing to participate:__________________________________________

By signing the subject certifies that he or she is at least 18 years of age.
Appendix II: Paper and Pencil Surveys

Pretest

Subject #:  
Date:  

Please answer the following questions as honestly as you can. Thank you for your time and honesty.
I. Directions: Read each item carefully. Using the scale shown below, please select the number that best describes how you think about yourself RIGHT NOW and put that number in the blank provided.

<table>
<thead>
<tr>
<th></th>
<th>Definitely False</th>
<th>Mostly False</th>
<th>Somewhat False</th>
<th>Slightly False</th>
<th>Slightly True</th>
<th>Somewhat True</th>
<th>Mostly True</th>
<th>Definitely True</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>5</td>
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<tr>
<td>6</td>
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<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

1. If I should find myself in a jam, I could think of many ways to get out of it
2. At the present time, I am energetically pursuing my goals
3. There are lots of ways around any problem that I am facing now
4. Right now I see myself as being pretty successful.
5. I can think of many ways to reach my current goals
6. At this time, I am meeting the goals that I set for myself

II. Directions: Read each item and then mark the appropriate answer in the space provided RIGHT NOW, to what extent do you experience the following feelings?

<table>
<thead>
<tr>
<th>very slightly or not at all</th>
<th>a little</th>
<th>moderately</th>
<th>quite a bit</th>
<th>extremely</th>
</tr>
</thead>
<tbody>
<tr>
<td>_____ confident</td>
<td>_____</td>
<td></td>
<td>_____ shaky</td>
<td></td>
</tr>
<tr>
<td>_____ worried</td>
<td>_____</td>
<td></td>
<td>_____ eager</td>
<td></td>
</tr>
<tr>
<td>_____ inspired</td>
<td>_____</td>
<td></td>
<td>_____ anxious</td>
<td></td>
</tr>
<tr>
<td>_____ fearful</td>
<td>_____</td>
<td></td>
<td>_____ challenged</td>
<td></td>
</tr>
<tr>
<td>_____ energized</td>
<td>_____</td>
<td></td>
<td>_____ threatened</td>
<td></td>
</tr>
</tbody>
</table>
Posttest

Subject#: 
Date:

Please answer the following questions as honestly as you can. Thank you for your time and honesty.

1) Did you find the videotape humorous?

<table>
<thead>
<tr>
<th>Definitely No</th>
<th>No</th>
<th>Somewhat</th>
<th>Yes</th>
<th>Definitely Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

2) Approximately how many times did you laugh out loud during the videotape?

________________________________________
I. Directions: Read each item carefully. Using the scale shown below, please select the number that best describes how you think about yourself RIGHT NOW and put that number in the blank provided.

<table>
<thead>
<tr>
<th></th>
<th>Definitely True</th>
<th>Mostly True</th>
<th>Somewhat True</th>
<th>Slightly True</th>
<th>Slightly False</th>
<th>Somewhat False</th>
<th>Mostly False</th>
<th>Definitely False</th>
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</thead>
<tbody>
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<td>True</td>
<td>True</td>
<td>True</td>
<td>True</td>
<td>True</td>
<td>True</td>
</tr>
<tr>
<td>3</td>
<td>True</td>
<td>True</td>
<td>True</td>
<td>True</td>
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<td>True</td>
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<td>True</td>
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<tr>
<td>4</td>
<td>True</td>
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<td>True</td>
<td>True</td>
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<td>True</td>
<td>True</td>
</tr>
<tr>
<td>6</td>
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<td>True</td>
<td>True</td>
<td>True</td>
<td>True</td>
<td>True</td>
<td>True</td>
<td>True</td>
</tr>
</tbody>
</table>

1. If I should find myself in a jam, I could think of many ways to get out of it.
2. At the present time, I am energetically pursuing my goals.
3. There are lots of ways around any problem that I am facing now.
4. Right now I see myself as being pretty successful.
5. I can think of many ways to reach my current goals.
6. At this time, I am meeting the goals that I set for myself.

II. Directions: Read each item and then mark the appropriate answer in the space provided. RIGHT NOW, to what extent do you experience the following feelings?

<table>
<thead>
<tr>
<th></th>
<th>very slightly or not at all</th>
<th>a little</th>
<th>moderately</th>
<th>quite a bit</th>
<th>extremely</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>confident</td>
<td>shaky</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>worried</td>
<td>eager</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>inspired</td>
<td>anxious</td>
<td></td>
<td></td>
<td></td>
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<td>4</td>
<td>fearful</td>
<td>challenged</td>
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<tr>
<td>5</td>
<td>energized</td>
<td>threatened</td>
<td></td>
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</tr>
</tbody>
</table>
### Appendix III: Tables of Raw Data

#### Table 6

State Psychological Measures By Gender and Condition

<table>
<thead>
<tr>
<th>Subject</th>
<th>Gender</th>
<th>Sense of Humor* Rating</th>
<th>Intervention</th>
<th>State Hope Scale</th>
<th>Brief Assessment of Mood</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Pre-Hope (Before Intervention)</td>
<td>Post-Hope (After Intervention)</td>
</tr>
<tr>
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<td>F</td>
<td>Medium</td>
<td>Humor</td>
<td>42</td>
<td>42</td>
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<tr>
<td>2</td>
<td>F</td>
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<tr>
<td>3</td>
<td>M</td>
<td>Medium</td>
<td>Humor</td>
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<td>F</td>
<td>Medium</td>
<td>Humor</td>
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<td>42</td>
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<td>Subject</td>
<td>Gender</td>
<td>Sense of Humor* Rating</td>
<td>Intervention</td>
<td>Brief Assessment of Mood</td>
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<td>Post-Hope (After Intervention) (Pre)</td>
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<td>38</td>
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</table>

* data obtained 6 months prior to experiment

** did not get data
Table 7

Subjects' Appraisal of Humor Condition

<table>
<thead>
<tr>
<th>Subject</th>
<th>Rating (1-5) of Humorous Video</th>
<th>Subjects' Self-Report of # of Times Laughing</th>
</tr>
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<tbody>
<tr>
<td>2</td>
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<td>0</td>
</tr>
<tr>
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<td>5</td>
<td>12</td>
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<tr>
<td>13</td>
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</tbody>
</table>

* did not ascertain data
women's data in bold
### Table 8

Standardized Skills Test Scores by Condition and Gender

<table>
<thead>
<tr>
<th>Subject</th>
<th>Relaxation Condition: Females</th>
<th>Neutral Condition: Females</th>
<th>Humor Condition: Females</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Skills Test 1</td>
<td>Skills Test 1</td>
<td>Skills Test 2</td>
</tr>
<tr>
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<td>43.70</td>
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<td>108.60</td>
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<td>66.70</td>
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<td>89.70</td>
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<tr>
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<td>49.35</td>
<td>56.35</td>
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</tr>
<tr>
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<td>80.30</td>
<td>153.90</td>
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<tr>
<td>5</td>
<td>43.70</td>
<td>64.90</td>
<td>108.60</td>
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<td>71.30</td>
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</table>
### Relaxation Condition: Males

<table>
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<tr>
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<th>Average of Skills Tests 1, 2</th>
</tr>
</thead>
<tbody>
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<td>Backhand</td>
<td>Forehand</td>
</tr>
<tr>
<td></td>
<td>Total</td>
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<tr>
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<td>93.60</td>
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### Neutral Condition: Males

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<th>Skills Test 2</th>
<th>Average of Skills Tests 1, 2</th>
</tr>
</thead>
<tbody>
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<td>Forehand</td>
<td>Backhand</td>
<td>Forehand</td>
</tr>
<tr>
<td></td>
<td>Total</td>
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<td>80.40</td>
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</table>

* did not ascertain data
<table>
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<tr>
<th>Subject</th>
<th>Skills Test 1 Forehand</th>
<th>Skills Test 1 Backhand</th>
<th>Skills Test 2 Forehand</th>
<th>Skills Test 2 Backhand</th>
<th>Average of Skills Tests 1, 2</th>
</tr>
</thead>
<tbody>
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<td>74.40</td>
<td>85.20</td>
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**Humor Condition: Males**
Appendix IV: Tennis Skills Test
A Tennis Forehand-Backhand Drive Skill Test Which Measures Ball Control and Stroke Firmness

KEN PURCELL
Murray State University

A tennis skill test for use in quantifying achievement in the forehand and backhand drive strokes was developed and then validated using 76 college women enrolled in beginning tennis classes. The test consisted of returning balls pitched by a pneumatic ball machine into target areas drawn in chalk on a regulation tennis court. Speed of the subjects' shots was assessed by measuring accumulated time in flight for rounds of 10 trials using a stopwatch. A time factor was then employed to correct the target value total for the trial to adjust for ball speed, thus rewarding the more skilled player who could stroke the ball more firmly while still retaining control. The test-retest reliability of the test was found to be .84, while the validity of the test, using judges' ratings as a criterion, was .83. It was concluded that the test was a valid and reliable test of skill which was closely related to the actual game situation. Percentile norms were developed on a limited number of subjects.

Key words: skill testing, tennis.

Tests of tennis skill have generally employed techniques which do not relate closely to actual game conditions. Wall volley tests (Dyer, 1955; Dyer, 1938; Hewitt, 1965), while exhibiting reasonably high validity and reliability, allow certain practices which can lead to gross errors in quantifying tennis skill in individual cases. Because the student may use a modified grip, may use primarily forehand shots, and may rally the ball in any manner at all, it is possible for some ingenious but rather unskilled players to score much higher than their actual playing ability would warrant.

Ball drop tests, where the student drops and hits balls over the net into target areas (Broer & Miller, 1950), also have yielded acceptable validity and reliability, but tend to promote discontent among some students who claim (sometimes with good reason) that they cannot drop and hit a ball as well as they can hit the ball in a more game-related situation.

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Standardization of Pitch

In order to standardize the speed and bounce of the pitched balls three factors were controlled: speed, angle of projection, and direction. The ball machine was placed just outside the baseline at the center mark (see "C" on Figure 1) so that all balls were projected directly down the center of the court to the subject who stood about 5 to 6 ft. inside the baseline at the opposite end of the court from the machine (see "B" on Figure 1). The machine's speed and angle of projection were adjusted to provide pitched balls that were considered ideal for optimum stroking by beginning and intermediate level players. This was accomplished by projecting the ball in such a manner as to cause it to pass approximately 2.5 ft. above the center of the net, strike the court about the service line, and then bounce to its highest point approximately 3 ft. short of the baseline. When set in this manner the ball reached a maximum height of about 3 ft. on the bounce, providing a pitch that the typical beginning to intermediate player had little trouble stroking. When set in the correct manner the horizontal velocity of the pitched ball was approximately 97 ft/sec. When timed from the moment of ejection to contact with the court at the service line, a mean elapsed time of 1.02 sec was obtained.

Judges' Rating System

In order to determine the validity of the skill test, the instructor of the classes and an outside observer (also a skilled player and tennis instructor) rated each subject on a 20-point scale. The directions for using the rating instrument instructed the evaluator to rate each player on a 20-point scale according to expectations for a person at the conclusion of a one semester hour, beginning tennis course. The evaluator was to consider only the stroke being evaluated—forehand or backhand—with regard to such factors as swing technique, footwork, consistency, and effectiveness of strokes. The rating instrument consisted of a 20-point scale ranging from "very, very poor" (0–1 points) to "superior" (19–20 points) with categories and assigned-point values for various skill levels including poor, below average, average, above average, and excellent.

Evaluation was performed at different times by the two judges within 1 week of the administration of the skill test. Subjects were hitting balls projected by a ball machine at the time of the evaluation, a practice technique used throughout the entire tennis course.

The judges' rating form for evaluation was chosen in lieu of the use of a round-robin tournament, since the skill test was designed to measure skill in the forehand and backhand drives, not to predict who might win in a real game situation where skill in serving, use of strategy, endurance, and other factors would play a major role in the outcome.

Statistical Analysis

The ratings by the two judges were correlated for comparison and then averaged for use as a validity criterion. The various scores calculated from the skill test data were then correlated, using the Pearson product-moment technique, with the criterion ratings to determine the validity of the skill test.

A subgroup of 26 subjects was given the entire test (forehand and backhand, two rounds each) twice on separate days. The scores for these subjects were correlated to determine the test-retest reliability.
The more closely a skill test resembles the actual game situation, the more acceptable it is likely to be to the student. While reliability and validity coefficients may be sufficient justification to the professional instructor, adolescent and young adult students are likely to be more responsive to the game-relatedness of the test.

The purpose of this study was to develop a valid and reliable tennis forehand and backhand drive skill test which would resemble closely the actual game situation.

**Rationale**

Success in tennis requires many attributes including speed, agility, endurance, mental alertness, and neuromuscular skill. While all are important at any level of play, skill is the dominant concern at the beginning and intermediate instructional levels.

When teaching novice tennis students, the forehand and backhand drives receive the bulk of attention, for these strokes generally constitute the vast majority of shots used in a game of tennis. Although some attention should be given to other strokes such as the serve, volley, and lob, a major objective of beginning level classes is to develop skill in the forehand and backhand drives.

The factors of importance in assessing the effectiveness of forehand and backhand drives are speed, direction, and depth. Hewitt (1966) devised a test which required the student to stroke a ball, directed to him/her by the instructor, across the net and into a target area. Hewitt's test was concerned with depth, as higher target values were assigned to areas nearer to the baseline. The test made no attempt to assess direction, as a shot down the center of the court was equal in value to a shot landing in either corner of the court. A rope stretched above the net was used to reward the player for striking the ball with firmness, since more points were scored for shots passing below the rope than for those going over it.

The skill test devised in this study evaluates depth and direction by rewarding the student more for shots directed deep to the center of the court, while penalizing the student for being short, long, or wide of the mark. Speed is considered by measuring the time required for the ball to travel from the racquet to the target. A certain degree of "face validity" is inherent in the test since it employs a method which closely resembles a very important phase of the actual tennis game.

**Methods**

The subjects for the study were 76 college women, ages 18-28, enrolled in one semester hour elective beginning tennis courses at Murray State University. Data used in the study were collected during the final week of the courses which each consisted of approximately 1500 min of tennis instructional time.

**Test Administration**

A pneumatic ball pitching machine called "The Prince" produced by Prince Manufacturing, Inc. of Princeton, N.J., was used to propel pressureless tennis balls in good condition to the subjects who attempted to return the pitched ball back over the net and into target areas with point values assigned (see Figure 1). Each subject, after being given 3 practice forehand shots, was administered 10 consecutive balls approximately 4 sec between trials to be returned with a forehand stroke, followed by 3
backhand practice balls and then 10 consecutive trials to the backhand. An identical second round of forehand and backhand trials was administered later during the same class period.

Target Areas

Target areas (Figure 1) were marked on the court using ordinary board chalk. The subject attempted to drive the ball down the center of the court, keeping the ball deep but within the court. Shots off line and/or too short or too long received lower point values as indicated on the figure.

Time Factor

If no consideration were given to the firmness of the shots used in the test, a subject might lob or “bloop” the balls over the net and into high point value areas on the target. To assess the firmness of the shots and thus reward the more skilled player who could drive the ball with greater velocity, a time factor was employed. The experimenter and an assistant (recorder) stoodjust outside the doubles court at the service line extended (see “A” in Figure 1) so that a good view of both the subject and the target areas was possible. Using a stopwatch with a single start-stop button which allowed time to accumulate, the experimenter started the watch on each trial at the instant of racquet contact with the ball and stopped it when one of the following events occurred: the ball struck the target, the ball struck the net or ground on the subject’s side of the net, or it became apparent that the ball would not land within the target area. “Let” balls which barely touched the net and continued on reasonably unimpeded were treated as though they had not contacted the net. Balls which were clearly deflected by the net were treated differently because (a) there was a natural tendency for the timer to impulsively stop the watch upon such net contact, and (b) deflected balls often resulted in a disproportionately great time accumulation relative to the subject’s stroke firmness. Since the purpose of timing shots was to assess stroke firmness, it appeared unfair to allow such let balls to unduly increase the
subject's time, especially since lobs are sometimes very effective shots in actual tennis play. When balls were clearly deflected by the net the stopwatch was stopped upon net contact and an untimed substitute trial was awarded. Because lobs seldom occurred there was little opportunity for ingenious subjects to take advantage of this procedure by lobbing on the untimed trial. At the conclusion of the 10 trials the accumulated time was read and recorded to the nearest second.

The more firmly the ball is stroked, the lower the flight time for a ball striking near the baseline. In view of this fact, the sum of the target values for each round (10 trials) was multiplied by a factor inversely related to the total time in flight (TF) for the round, taken from the stopwatch, i.e., the larger the TF, the smaller the factor used (see Table 1). Since the mean TF was approximately 12 seconds, this time was assigned a factor of 1.00. Factors varying from .70 to .35 were then somewhat arbitrarily produced by considering the range of TFs encountered in the study. In this manner, point value scores totals for each round were increased or decreased by up to 30–35% based upon TF, an amount of consideration deemed appropriate for stroke firmness.

Table 1

<table>
<thead>
<tr>
<th>TF for 10 trials</th>
<th>Correction Factor</th>
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<tr>
<td>5 sec.</td>
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<tr>
<td>6</td>
<td>1.30</td>
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<tr>
<td>7</td>
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<td>17</td>
<td>.75</td>
</tr>
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<td>18</td>
<td>.70</td>
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</table>

A low TF was not necessarily an indication of how hard the subject stroked the ball, since trials in which the ball was completely missed or hit into the net accumulated very little time. However, since subjects with many such unsuccessful trials tended to have very low target value totals, the resulting score tended also to be very low. The optimum domination of TF and target value total would result only by stroking the ball firmly and placing it into the higher target value areas consistently. As in a true game situation, the subject had to decide how much power could be used and still retain the consistency and control to score points.

Each subject was given two rounds of 10 trials each for both the forehand and backhand strokes. The total of the target value scores in each round was multiplied by the time factor from Table 1 using the accumulated stopwatch time for the 10 trials. Forehand, backhand, and total scores were calculated. The forehand and backhand scores were the mean of the two rounds, while the total score was the sum of the forehand and backhand means.
Scores derived from each of the two individual 10-trial rounds (for all subjects, forehand and backhand) were also correlated to give an indication of reliability, as were total scores calculated by adding scores from the first forehand and backhand rounds, and scores from the second forehand and backhand rounds.

Reliability

The test-retest reliability coefficient calculated for the total scores (forehand plus backhand) for the subgroup of 26 subjects was .84, significant beyond the .01 level (r > .45), an acceptably high reliability for the skill test. Similar reliability coefficients of .86 and .83 were obtained for the forehand and backhand portions of the test, respectively.

When the scores for the two 10-trial rounds for the entire group of 76 subjects were correlated, the beneficial effects of using a time factor became evident. For the forehand scores the reliability estimate without considering time in flight (TF) was .75, while with TF reliability rose to .87. A correlation of .30 was required for significance at the .01 level. For the backhand scores the TF effect was smaller as indicated by correlations of .68 without TF and .67 with TF. For total score the reliability between individual rounds was .73 without TF and .79 with TF. This reliability coefficient of .79 indicates that a reasonably high correlation exists between the first and second rounds. Thus it is possible that, if time were limited, only single forehand and backhand rounds might be administered, rather than two rounds each.

It should be cautioned, however, that since mean scores for the second rounds were slightly higher than for the first rounds (forehand round one = 29.1, round two = 31.5; backhand round one = 21.7, round two = 25.1; total round one = 50.8, round two = 56.6) norms provided herein should not be used if only one forehand and backhand round is given.

Validity

The correlation between the skill test total score and the judges' ratings (mean) indicated a validity coefficient of .85 when TF was considered. When target value scores alone were used without considering TF, the validity was reduced to .76.

For the forehand portion of the test TF had no apparent effect on validity, as the correlation was .79 both with and without TF. However, for the backhand portion of the test, using TF resulted in a correlation of .83, while without TF the correlation was only .65.

The correlation between the forehand and backhand portions of the test yielded a coefficient of .75, demonstrating that a relationship exists between forehand and backhand skill. This correlation was not considered high enough to justify using only one stroke instead of two.

To assess the objectivity of the two judges in rating the abilities of the subjects, the rating system scores by the two judges were correlated. The resulting coefficient of .87 indicated that the judges were in good agreement on the relative abilities of the subjects.

Discussion

Firmness of Stroke

During all data collection sessions subjects were aware that a higher score could be obtained by hitting the ball more firmly. Thus they were not inclined to hit the ball
I softly in order to get higher target values. Most subjects tended to stroke the ball as firmly as possible while still retaining good control. While the validity and reliability coefficients tended to be only moderately higher with TF considered, it is possible that more marked differences might have occurred had subjects taken the test both with and without a time factor, knowing, of course, when hitting the ball harder would be reflected in the scoring.

Administration Time

Since balls were projected at a rate of one every 4 sec and each subject was given 13 forehand trials (including practice) followed immediately by 13 backhand trials, a total of about 1.75 min was required to give a subject one complete forehand and backhand round. Since two rounds were given each subject the total time per subject for actual testing was about 3.5 min. Very little wasted time occurred between subjects, since the succeeding subject was waiting close by to step up and begin her practice shots as soon as the previous subject completed testing. The test administrator could have the time in flight recorded from the stopwatch and announce the name of the next subject while practice shots were being taken.

Norms

The percentile norms established using the scores of 76 college women at the conclusion of a one semester hour course in beginning tennis are presented in Table 2. While of only limited value because of the size of the sample and the specific nature of the tennis course, these values may be used as a general basis of comparison in other testing situations. The norms are presented for the forehand, backhand, and total skill test. The means for the tests were 30.3 (SD = 9.4) for the forehand, 25.6 (SD = 9.5) for the backhand, and 53.9 (SD = 17.7) for the total score.

Adaptation of the test

Because some ball pitching machines do not provide for adjustment of speed and/or angle of projection, it may be necessary in some instances to use a pitch that

| Table 2 |
|---|---|---|---|
| **Percentile** | **Forehand** | **Backhand** | **Total Score** |
| 100 | 60 | 44 | 100 |
| 90 | 47 | 37 | 92 |
| 80 | 40 | 33 | 84 |
| 70 | 36 | 30 | 74 |
| 60 | 30 | 26 | 64 |
| 50 | 27 | 22 | 54 |
| 40 | 24 | 20 | 43 |
| 30 | 22 | 18 | 39 |
| 20 | 20 | 16 | 36 |
| 10 | 17 | 14 | 33 |
| 0 | 20 | 11 | 20 |
varies in speed and bounce from the established standard. While such a practice
would obviously invalidate the use of the normative data provided, it would not
prevent the use of the test. In various trial studies the use of pitches of differing
speed and bounce were found to have little effect upon the subjects' ability to score, as
long as the speed and bounce were within a reasonable range and the pitches were
consistent.

The advantages of using a ball machine are obvious, both in terms of pitch
consistency and the freedom of the instructor to perform other testing duties.
However, if a ball machine is not available, the test might be administered by
projecting the ball manually, either by throwing or hitting. If this practice were used
the consistency of the pitches would be of primary concern and allowances for
nonconforming pitches by administering substitute pitches would be necessary. The
validity and reliability data gathered in this study likely would not apply to a test
administered without a ball pitching machine.

While the subjects used in this investigation were college females with minimal
tennis experience, the test should be effective for assessing skill of males and females
of various ages and abilities.

The similarity between the test and actual game situations, owing to the use of a ball
machine and a time factor to evaluate ball velocity, allows players to see the relation-
ship between the test and the actual game. This tends to be a major advantage of the
test over wall volley and ball-drop type tests.

Conclusions

The following conclusions were drawn from the investigation:

1. The skill test developed has sufficient reliability and validity to warrant its use in
   assessing achievement in a variety of academic and nonacademic settings.
2. Although college females were employed in its development, the test should be
   of value in assessing tennis skill in subjects of other ages, sex, and ability levels.
3. The test has a notable advantage over most other tennis skill tests in that it
   utilizes a testing protocol that is quite similar to the actual game situation.
4. A second major advantage of the test is its ability to evaluate tennis skill by
   considering both ball control and velocity.
5. A disadvantage of the test may be the availability of a ball pitching machine,
   although the test might employ a human ball-tosser as an alternative.

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