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The Effects of Stressed Tempo Music on Performance Times of Track Athletes

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THE EFFECTS OF STRESSED TEMPO MUSIC ON PERFORMANCE TIMES OF TRACK ATHLETES

BY

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ABSTRACT

This study was conducted to assess whether stressed tempo music would effect performance rates of track athletes. The music the athletes listened to was systematically increased over a three-week period to determine if the track athletes' times became faster. The participants of this study were measured during practice for the times in which they ran the 400 meters, or one lap around a track.

The 27 track athletes that were a part of this study were randomly assigned to the experimental group (n=12) or the control group (n=15). The experimental group was provided with Compact Disks (CD) of their music preferences with altered tempos. The control group practiced two times a week without music. The experimental group listened to their selected music twice a week. Both groups were timed once a week (Mondays) during the four-week period.

Both groups were made up of members of the track and the cross-country teams. The cross-country team's practice schedule consisted of Monday speed workouts. On Monday's the cross-country team would run 5 to 6 400 meters. The cross-country team would 400 meters and then have a short rest period before they were to run it again. The track team ran two 400 meters with rest in between each day in addition to their practice schedule of speed drills for turn-over, hurdle drills, jumping exercises, etc. to help build up their stamina.

Graphic analysis of the data revealed differences during Monday practices of those involved in the experimental group. The experimental group was able to decrease their times while running 400 meters by an average of half a minute. The control group's times slightly decreased by about two minutes.

The results of this study show that track athletes who listen to music with slightly increasing tempos can decrease their running times.

CHAPTER 1

INTRODUCTION

Music has historically been a tool to help athletes succeed, inspire, celebrate their victories, or help maintain pacing. For example, one of the competitions in the Panathenaic games was boat racing (Miller, 2004). The skills required for this event were the same as those used by oarsmen in Greek warships. These narrow ships were propelled by oarsmen seated in three banks on each side (Miller, 2004). In addition, each boat had a captain and boatswain, or keleustes whose job was to give the beat to the oarsmen. The skill of the oarsman rowing to the beat is a historical example of the use of music, or rhythm to increase efficiency during competition. (Miller, 2004 p. 11).

Even in ancient times, people knew that music could influence and motivate athletes. In recent years, there have been studies performed to gain better knowledge of how athletics and music work together. Today, the presence of athletes and music go hand-in-hand. It would not be as exciting to watch a basketball game without the music that is used to encourage players and stimulate the crowd. Observing track and field events, or ice skating competitions, the performers can be seen using head phones and focusing their attention on their upcoming event. This study investigates the effects of using music to assist pacing and enhance the athletes' performances.

CHAPTER 2

REVIEW OF LITERATURE

History of Running

The presence of athletes and sporting events has been around for many years. There were notable sports and games that were popular around the globe as far back as 1,500 years ago (Craig 2002). Many may wonder what is the definition of sport? Craig defines sport as activities that are rule-governed, have some degree of organization, and usually determine a victor or superior performers (p. xii). Sports were often given significant social or religious meaning by the people who played them and often involved spectators (Craig 2002, p. xii).

Running has been found in many ancient cultures from Africa, Europe, Latin America, the Middle East and North America. Craig (2002) states in his book, that in ancient Egypt, running served multiple purposes from the important and regimented training of troops, to the highly ceremonial Jubilee Run by the pharaohs that was a specific means of demonstrating to the masses that the pharaohs enjoyed strong health and superiority (p.21). Baker hypothesized that distance running seems natural for some Africans. He indicated that running by Africans was enhanced by a lack of mechanized, motorized transportation (Baker 987, p. 280).

Abebe Bikila, a member of the Ethiopian Imperial Guard, shocked the sporting world by winning the 1960 Olympic marathon while running barefoot and then repeating the win four years later wearing shoes and socks (Craig, 2002, p.19). Many African runners have given extraordinary performances at Olympic events showing African runners to be among the world's elite distance athletes (Craig 2002). Marathon racing has been, and is, a big success for many Kenyans. Though many Kenyan coaches discouraged their athletes from running the marathon, long-distance running is such a revered part of the culture that a runner appears on the country's 20-shilling note (Craig 2002).

In Latin America the most famous runners were the postal messengers employed by the great Aztec and Incan Empires (Craig 2002). Their job as couriers was to

describe ships, guns, and troops to the Aztec ruler, Montezuma, within 24 hours of Cortez' landing that was 260 miles from the Aztec capital of Tenochtitlan --Modern Mexico City. (Craig 2002,p.129). Additionally, champion runners in Latin America were called *soijens*. This title was reserved for men who competed in formal races that took place on racetracks. The races were judged by arbitrators, who were usually old men representing the different communities. During these races the men would decorate their bodies with special paint and would wear a bracelet of feathers (Craig 2002,p.129).

Coaches and athletic trainers have searched for years to find the perfect training technique for athletes. Wiksten and Peters (2000) wrote about techniques of endurance training. Endurance training involves interval training or repeated bouts of exercise with brief recovery periods between each interval (Wiksten and Peters 2000, p.65). In order to improve aerobic power, the length of the work interval should be greater than 60 seconds (Wiksten and Peters 2000, p.65).

Beck (1999) wrote about a phenomenon in running called "tempo run." He defined "tempo run" as nothing more than 20 minutes of steady running at threshold pace. Threshold pace is the effort level just below which the body's ability to clear lactate, a by-product of carbohydrate metabolism, can no longer keep up with lactate production. Beck states that this pace varies for most people depending on the course for which the athlete is training. Beck (1999) explains that the most important aspect of a tempo run is maintaining a specific and consistent pace.

With the many techniques used to help runners improve their times, there have been some conflicts with tempo runs that ask for other practice alternatives. Anderson (1998) stated that most runners carry out regular tempo runs in hopes of boosting their lactate-threshold (LT) running speed. New studies have shown that tempo training is not the most effective way to heighten LT. Because a "tempo run" is a continuous three to four- mile effort at a speed which is about 10 to 15 seconds slower per mile than 10 kilometer velocity, the lactate production during this run is fairly minimal (p. 1). Anderson (1998) wrote that runners should want to pick up as much lactate as possible in their muscles because it is an important source of energy for muscles. This can be achieved when runners are conducting workouts at a slow jog. When athletes produce

lactate during a jog, the muscle cells are taking it in to use for fuel (p. 1).

Even with training techniques like interval training (running a short distance the first time and increasing the distance with each additional run), it is obvious that the technique may not work for every one. Examples of interval training include running 200 meters and moving to 300 meters after a brief rest period. The intervals can go as far as the athlete can handle. Edwards (2004) stated that, "there is no one-size fits –all universal training method. Exercise must be individually tailored to fit you". On a website titled run.gear.run other suggestions of training techniques are given. Counting the steps is one such technique that further (2004), suggests that runners use a cadence. This write-up stated that, "a running cadence is the measure of how many foot strikes either the right or left foot makes in one minute". This use of a cadence has been used for many years to help jumpers maintain their steps during practice or competitions.

Galloway (1998) believes the real secret to improve distance while running is to run with a faster turnover, or cadence. He believes that "overstriding" can lead to a greater risk of injuries. Runners should count their steps to see how they can speed up their cadence. During this drill, Galloway (1998) suggests that the runner begins to run at normal training pace. After the momentum is built up, the runner must count for exactly one minute the number of times the right foot pushes off. Multiply the number of times the right foot pushes off by the number two, and that equals the runner's current turnover rate. Each time the runner attempts this equation again, they must try to increase the number of right foot push offs' to increase their turnover. Many studies have been conducted to find ways to help athletes perform to the best of their abilities and an overview of that research follows.

Related Research

To talk about athletes, it is necessary to discuss anxiety. This can be an important factor when dealing with practice techniques. If a person is suffering from anxiety, it can have a great effect on their performance, including those in music performance. Abraham and Schneider (2001) discuss the ways to cope with music performance anxiety. They give a list of ten common cognitive distortions that people use. When looking at these distortions, you are to rate yourself from one to ten with one being low and ten being high. The purpose of their strategy is to stop using those distortions and

think in another way. These distortions include all or nothing thinking. If you see yourself as falling short of perfect you see yourself as a total failure. Overgeneralization- causes one to see a single negative event as a never-ending pattern of defeat. Mental filter is when you pick out a single negative detail and dwell on it. Disqualifying the positive is when one rejects positive experiences by insisting they "don't count" for one reason or another. Jumping to conclusions is when one makes a negative interpretation even though there are no definite facts that support their conclusion. Reading is when a person concludes that someone is reacting negatively to you. Magnification or minimization is when you exaggerate the important things. Emotional reasoning is when you assume that your negative emotions necessarily reflect the way things really are. Should statements are used when you try to motivate yourself with should and should not as if you had to be whipped and punished before you could be expected to do anything. Labeling and mislabeling is an extreme form of overgeneralization. Instead of describing the error, the individual attaches a negative label to oneself. "I'm a loser." And last, but not least, personalization. This is when the individual sees him or her as the cause of some negative external event, in which they are not primarily responsible for.

Music has been used to reduce anxiety in medical settings. Haun, Mainous, & Looney (2001) conducted a study of the effect of music on anxiety of women awaiting breast biopsy. They realized that patients awating surgery are generally anxious and are usually required to arrive at the hospital a hour and a half before an examination to complete blood work, and to have a preoperative assessment by the anesthesia department. Waiting alone for an operative procedure may be more traumatic than the surgery itself. Haun, Mainous, and Looney (2001) discovered that apprehension and tension accompanied by autonomic nervous system (ANS) arousal can lead to an increase in blood pressure, heart rate and respiratory rate (p.10). These symptoms of apprehension and tension can be potentially harmful because heightened levels of heart rate and blood pressure overwork the cardiovascular system and increase oxygen demands and also increase the heart's workload.

Haun, Mainous, & Looney (2001) discuss the fact that music has been used throughout the years to soothe and relax individuals and has been proposed as a means of decreasing the physiological and behavioral anxiety in individuals awaiting surgical

procedures. In this study, Haun, Mainous, & Looney (2001) compared changes in the anxiety levels of patients awaiting breast biopsy who received music therapy with patients who received customary preoperative care. The sample consisted of a group of 20 females. Ten of those females were a part of the experimental group and the remaining ten females were a part of the control group. The results showed that the patients who received music therapy required less anesthesia during surgery than those patients that received customary preoperative care.

Lanzillo, Burke, Joyner, & Hardy (2001) conducted a study that investigated the effects of individual participant's favorite music on the perception of intensity and direction or pre-competitive cognitive and somatic state anxiety, and state self-confidence in collegiate athletes. The intercollegiate athletes consisted of 50 subjects from a university in the south east. They were randomly placed in either group (music or non-music group). For a range of an hour and forty-five minutes to thirty minutes before competition, the subjects engaged in a three-minute session featuring uninterrupted, personally chosen, music which they listened to on a portable compact disc player. After the three-minutes were up, the athletes answered a modified competitive state anxiety inventory-two. Two days after the competition, all of the
participants completed a modified sport competition anxiety test. Results of this study showed that an individual music session that featured the participant's favorite music significantly enhanced feelings of state self-confidence in collegiate athletes.

Stevens and Lane (2001), conducted a study that examined strategies used to self-regulate mood dimensions assessed by the profile of mood states in athletes. The subjects consisted of 107 athletes who completed a 29 item mood regulation questionnaire. This assessed strategies aimed at regulating anger, confusion, depression, fatigue, tension, and vigor. The results of this study showed that to change location, exercise, and listen to music were strategies that were common to each mood dimension.

There has been another study that examined stress and exercise. Brownley (1992), did a study that examined the effects of music on psychophysiological stress responses to graded exercises. The subjects of this study consisted of 8 trained (T) and 8 untrained (UT) runners. These subjects were tested under three music conditions: no music, sedative music, and fast music. These three categories were given to the subjects at three

levels of running intensity; 40%, 60%, and 80% (low, medium, and high). Statistical analyses revealed increased respiratory frequency during the fast music as compared to no music and sedative music. Feeling (affect) was higher in the untrained running group at low intensity, but declined more severely from moderate to high intensity during sedative music. These results show that listening to fast music may help untrained runners, but did not assist much with the trained runners.

Hohne (1979) conducted a study that examined music in a physical environment and sports in other countries. Hohne (1979) experimented in England, Sweden, Australia and other countries, especially the Soviet Union which has shown that music is a powerful stimulus for athletic performers. He suggests the need for musicians and sports specialists to work together to produce closer more productive links between music and sport.

Ayers (1911), in a study of riders in a six-day bicycle race, found that the average riding times were faster when a band was playing than when the band was silent.
In a study by Cox (1986), the effects of different types of music on physical performance were examined. Two types of music were presented while subjects were being tested; stimulative and sedative music. The observations of the study included: 1) vertical jump, 2) hand grip strength, 3) performance on a pursuit rotor device, 4) reaction time, 5) movement time, 6) arm and shoulder strength as measured by a bench press, and 7) performance on a mirror tracing device. The results indicated that reaction time scores were significantly faster for the stimulative music groups than for the sedative music group.

Dillon (1952) investigated the effects of music upon swimming form and swimming speed. Two standard strokes were investigated over a period of three years. At the end of the study it was proven that the music group significantly improved in swimming form over the non-music group. The improvement in swimming speed was not significant between the two groups.

Swimming coach Jernberg (1982) studied the effects of stroke tempo upon competitive swimming performance. Jernberg, who was also a pianist, integrated the components of minimum strokes per length of the pool and stroking at a variety of specific tempos. With this technique, he helped each swimmer determine the exact tempo

of a race to achieve a desired race time.

There were also studies with music conducted with basketball players. Yanisch (1946), a basketball coach, believed that technique drills sets to popular music created a deeper interest among the players. She cited music as an aid in helping players to develop greater efficiency in handling the ball.

There were some speculations where investigators have reported that music had been an influential factor in the success of teams (Papa 1998, p.8). Frisch (1959) reported that music played an important role in the success of the 1934 St. Louis Cardinals as well as the 1912 Pittsburgh Pirates.

An investigation of the effects of selected types of musical stimuli upon muscular strength and endurance performance of college age athletes done by Papa (1998) took a close look at the effects of music and athletes. The athletes were tested with music that was stimulative, sedative and a non musical environment. The three periods the athletes were tested were completed during a one week period. This study revealed that muscular strength scores improved for subjects that listened to stimulative music conditions compared to the subjects that listened to sedative and non-musical conditions (p, iii).

In the study performed by Papa (1998), there was found to be no difference in the muscular endurance performance between stimulative, sedative and non-musical conditions (p, iii).

Another study by Gordin (1981) looked at the effects of hypnosis, relaxation training on music on state anxiety and stress in female athletes. Forty-seven intercollegiate female athletes were given a pretreatment assessment, then placed in groups consisting of hypnosis, relaxation training, music or control group (p, iv). Eighteen sessions of twenty minutes of hypnosis training were conducted. There were no significant differences between hypnosis, relaxation training, music, or control groups. There were significant differences between baseline heart-rate and verbal stressor heart rate phases.

Research on Rhythm and Athletes

M.V. Yermolaeva and M. M. Chirkova did research on the Effects of Mental Training on Sense of Rhythm. Yermolaeva and Chirkova (1996) believe that through

mental training athletes learn how to relax, focus attention and perform other simple and complex psychological skills (p.107). When it comes to sense of rhythm and performance Yermolaeva and Chirkova (1996) also believe that the increase in the level of technical mastery is closely associated with the enhancement of the rhythmic structures of sporting activities (p.107). Yermolaeva and Chirkova (1996) stated in their research that "their findings suggest that is athletes desire to recall the rhythmic structure of a motor movement or action, they must reproduce that action mentally. Furthermore, the recollection of rhythm is not a passive process. In contrast, recalling movements requires and demands active mental effort. Thus, the work that was done to imprint and enhance rhythm demands additional motor and mental efforts as well as the creation of a special psychological state. During this time the stage of specialized technical preparation, rhythm becomes the main criterion of subjective control of the perfect sporting performance" (p.107).

The research conducted by Yermolaeva and Chirkova (1996) indicated that the creation of rhythm depends essentially on the development of the appropriate emotional state (p.108). Yermolaeva and Chirkova (1996) believe that in stressful situations when the level of emotional excitement is very high, athletes may temporarily lose their sense of rhythm (p.108). Since it is the sense of rhythm that determines the integrity of the sporting action, performers that are out of rhythm do not usually perform well (Yermolaeva and Chirkova 1996, p.108).

There are certain factors that can affect studies done on athletes. One of these factors can be travel and sleep loss. According to Sharkey (1986), extended travel can elevate the heart rate and hamper performance. Sharkey (1986) also recommends rest after travel or sleep loss.

Research with music and exercise reveals great possibilities in the athletic world. Cauette and Reid (1991) discovered that music increased bicycle pedaling. A study conducted by Cauette and Reid (1991) looked at the effects of auditory and visual reinforcers on the time spent exercising. Results of this study proved that all subjects increased output over baseline conditions with both visual and auditory reinforcements.

There are now studies in music therapy that deal with neurologic components. Neurologic music therapy is the therapeutic application of music to cognitive, sensory

and motor dysfunctions due to neurologic diseases of the human nervous system (de l'Etoile, 2004). Curent work in the neuroscience of rhythm perception and rhythmic synchronization mechanisms has produced results in three major areas: 1) Empirical data and computational modeling of how the brain synchronizes rhythmic movement to external rhythm; 2) Evidence for subliminal perception of auditory timing information below the level of conscious perception, which the brain uses to guide the timing of rhythmic movement; 3) Brain mapping using PET- scanning technology to describe neural networks involve in rhythmic synchronization. (Unkefer', 2004).

Errol (1996), did research on the effects of music on an athletic weight training program. Specific areas of this study included individual's preference for the music being played in the weight room, individual's exercise motivation relative to the music, and individual recall of the type of music played during the weight training session. In the results, Errol (1996) found out that there was a statistically significant negative correlation that was found between group preference for music being played and group on-task.

Carmoney (1993), performed a study on the comparison of Choice Reaction Time (CTR) in the presence of selected rhythmical auditory stimuli. This study compared open and closed skilled athletes. Open skilled athletes are those with sport backgrounds in baseball and softball. Closed skilled athletes have sport background in golf, bowling, and billiards. Carmoney (1993) stated, "there is a trend among sport and exercise participants to use music played through personal stereo headsets, but it is not certain benefits out-weigh the possible risk." The results of this study proved that the even rhythmical condition was associated with significantly faster CRT's for open and closed skill athletes against the psychology students. The uneven rhythmical condition was associated with significantly faster CRT's for open and closed skill athletes against the psychology group. The silence condition was associated with significantly faster CRT's for open and closed skill athletes against the psychology group.

Gluch (1993), examined the use of music listening in preparing for sport performance. The participants of this study consisted of four female and two male Division 1 athletes. These athletes used music as a part of their pre-performance routine. The subjects were given in-depth interviews using open-ended questions which provided

the raw data themes that described the athletes' motivations for listening to music before competing in their sport. The answers to the athlete's questionnaire were abstracted to more general, higher-order themes and then put into major categories of self-regulation, feelings of well-being, mental preparation, memories, and confidence. The results of this study concluded that the athletes used music to manipulate arousal levels and assist in altering or controlling their thoughts and emotions. This is an integral part of enhancing levels of readiness prior to competing.

Vernaccchia & Cooke (1993) wrote an article that describes the influence that a mental training technique had upon the game performance of two intercollegiate basketball players. Athlete A was a member of the 1989 University of Kansas men's intercollegiate basketball team. Athlete B was a member of the 1989 Western Washington University women's intercollegiate basketball team. Player A's goal was to improve a shooting or scoring slump. Player B's goal was to improve her concentration during games. The metal training technique was a mastery rehearsal audio-cassette tape. The two athletes were instructed to identify their desired performance behaviors and goals by writing a script. This script vividly described how they would like to perform their skills in the actual game situation. The script was then recorded on an audio-cassette tape which was supplemented with background music selected by the athlete. Once the athletes were given the audio-cassette tapes, they were instructed to listen to the tape daily during the days leading up to competition. The results showed that the use of mastery rehearsal tape was an effective mental training technique.

Becker et al. (1994), did research on the effects of music on athletic performance. The subjects consisted of 60 volunteers from three age groups. These age groups included child, adult, and senior. The music to influence the group was mellow and frenetic tunes. These tunes were played before exercise and the subjects' mileage was assessed while riding a stationary bicycle. Each subject received three randomized 2-minute exercise trials. Each of these was preceded by 1-minute exposure to mellow music, frenetic music, or white noise. The mileage in both music conditions was significantly higher than that during the white-noise. The senior subject's mileage was significantly higher during white noise. Significant differences between frenetic and mellow music were not found during this study.

Templin & Vernaccchia (1995), conducted a study on the effect of highlight music video tapes upon the game performance of intercollegiate basketball players. The subjects involved in this study were 5 male intercollegiate basketball players. This study was designed to examine the effectiveness of highlight peak performance music videotapes on competitive offensive field goal percentage. Videotapes were supplemented by incorporating each player's best and most effective plays. Inspirational music was also added to the videotapes which were then viewed by the athletes throughout the competitive season. The results of this study demonstrated a mean increase of 4.7 percent in overall field goal percentage for 3 of the 5 participants.

A study was conducted on the effects of positive and negative music on performance of a karate drill conducted in a double-blind study (Ferguson, Carbonneau, and Chambliss, 1994). Fourteen volunteers from two Shotokan karate schools were used during this study. Each subject performed a pre-selected drill three times following positive (music with melodic lines and/ or structure) and negative (music without melodic lines and/ or structure) music and white noise. These three selections were given to the participant in random order. The performance of the drill was rated on a 7-item, 5-point scale. The rating was done by two raters that observed each subject. The results of this study showed an enhancement of performance for both types of music (positive and negative) over white noise.

Doiron, Lehnhard, Butterfiled, & Whitesides (1999), wanted to determine the effect of anaerobic exercise and music on plasma concentration of beta-endorphin in women. The study consisted of 13 female college athletes that were randomly assigned to groups. These groups exercised to either the presence or absence of music. Each group performed a 12-set (interval) resistance exercise circuit at maximal intensity. Blood samples of the two groups were extracted pre and post exercise. The blood samples were measured for plasma levels of beta-endorphin. Whole blood lactate levels were also measured pre and post exercise. The results of this study showed a significant pre to post increase in beta-endorphins. There were no significant differences in post exercise beta-endorphin levels between the no-music and music groups. Based on these results, the researchers found that a significant rise in beta-endorphin levels was a response to anaerobic exercise. This showed that it did not matter if the exercise was performed in the

presence or absence of music.

Thiese and Huddleston (1999), did a study to investigate the use of psychological skills by female collegiate swimmers. The swimmers that participated in the study consisted of 147 females. The female swimmers were from 10 Midwestern universities. The female swimmers were surveyed with a researcher-generated questionnaire. The means in this study indicated that goal setting positive self talk, and music for psy-up were the skills utilized "almost always" by the subjects. The sample was split into two groups including sprinters (n=105) and long distance swimmers (n=42). MANOVA revealed no significant differences between the skills used by the swimmers and distances swam by the athletes.

The purpose of this study was to determine whether music with increasing tempos affects running times of track students during practice.

CHAPTER 3

EXPERIMENTAL METHOD

Subjects

The subjects for this study were members of the Florida Agricultural and Mechanical University (FAMU) track team consisting of cross-country and track runners. The cross-country team begins competing early in the fall semester, whereas the track team begins competing in the early spring semester. This early training for cross-country athletes could have resulted in improved physical stamina for them. The track and cross-country teams combine near the end of the fall semester to create the full track team.

The subjects consisted of 12 experimental members and 15 control group members. After the athletes signed the consent forms and musical preference sheets, they were then instructed to initial their consent and musical preference forms. The experimental and control groups were chosen randomly by writing the participant's names on slips of paper and then placing them into a bag. The names for the experimental group were randomly pulled from the bag first, followed by the control group names. The make up of the experimental and control group can be viewed on Table 1.

Setting

The setting for this study was the FAMU track. Data were collected on Monday's during three practice times: 6:00 a.m. practice was for those on the cross-country team; 3:30 p.m. practice was for those on the track team; and 5:00 p.m. practice was for those cross-country runners that could not attend the 6:00 a.m. practice.

TABLE 1

MAKE UP OF GROUPS

EXPERIMENTAL GROUP

Subject	Gender	Team
1	M	Cross Country
2	M	Cross Country
3	M	Cross Country
4	F	Cross Country
5	F	Cross Country
6	F	Track Team
7	F	Track Team
8	F	Cross Country
9	M	Cross Country
10	M	Cross Country
11	F	Track Team
12	F	Track Team

CONTROL GROUP

Subject	Gender	Team
1	M	Track Team
2	F	Track Team
3	F	Cross Country
4	M	Track Team
5	M	Cross Country
6	F	Track Team
7	M	Track Team

TABLE 1 Continued

8	M	Track Team
9	F	Track Team
10	F	Track Team
11	F	Track Team
12	M	Track Team
13	M	Track Team
14	F	Track Team
15	F	Cross Country

Design

The design for this project included an experimental and control group with pre and post testing of time to run a quarter mile (400 meters).

The independent variable was stressed tempo music and the dependent variable was time for the set distance. Additionally, satisfaction with music during practice was assessed.

Procedure

The first step of the project was to collect baseline running times. The researcher recorded practice times using a Sport Line Alpha 461 Dual split stopwatch which was able to hold up to six splits (times) at once. After the base line was established, the athletes who were randomly chosen for the experimental and control group after which they were given personal CD players with individual CD's that were set to the individual's baseline speed. The speed of the baseline was set as close to music chosen as possible. Some times were so slow that it caused distortion of the recording. In times like these the athlete had to be instructed by the researcher to step on every other beat instead of on the beat.

Equipment

The CD players consisted of five Durabrand Digital 60 model number CD-85. These specific CD players were jog proof so they would not skip under strenuous activity. The other three CD players provided for the athletes were a Durabrand AM/FM radio CD player model number CD-625. All of the CD players came with headphones and the subjects were provided with Duracell ultra batteries from the researcher. The CD players were distributed to the subjects at a first come first serve basis.

Athlete's times were converted to metronomic setting/pulse using total seconds of running time to equal the metronomic setting (i.e., 1.4 min = 84 on metronome). Once the metronome setting for each subject's baseline was determined, the music the athletes had chosen was altered through use of a wave lab program. The wave lab program was located at the Florida State University Department of Dance. The director of the Music Resource Center taught the researcher how to use the program and

the wave lab manual. Carlson, Nordmark and Wiklander (2002) developed the process in which the CD's for the athletes was created is called "time stretch." This operation can allow an individual to change the length of a recording without affecting its pitch. Not only can one stretch the length of the music, but it can also be shortened. Time stretch in wave lab is predominately used to make a section of audio fit within some other material (p. 178). When opening the program to modify the music, five items show up on the screen: 1) the settings of a particular song that was picked for the study, 2) original length of samples, 3)the original length in seconds, 4) the calculated original tempo is displayed, 5) and bars and meters are also displayed. The only thing that is to be adjusted is the tempo. Once the tempo is adjusted to the desired setting, the other settings will change to fit the new tempo. Even though there are many advantages to using this program, there are some limitations. Time stretch is a very complicated Digital Signal Processing (DSP) operation and requires complicated mathematical operations. This will always affect the sound quality to some extent (p.181). The maximum range is 50 % (half speed) to 200 % (double speed). Extreme values can only be used for non-critical applications and special effects. The wave lab program was used to compress and expand music from the original CD via computer recorded music with the altered tempo recorded back to a CD.

The music selected by all athletes was collected from CD's or via the Internet and burned onto two blank CD's. Once the groups were specified, the musical selections for those chosen for the experimental group were re-burned onto blank CD's. Each week the subjects received one CD paced for that practice. After each practice the researcher would collect the CD's so they could be re-distributed for the next week.

There were a total of three CD's made for each subject which was a total of 36 CD's produced for the subjects in the experimental group. The CD's contained information on them in writing that included the subject's number (subj. #1), the week the CD was used (ex. week 1, week 2, etc.), the subject's initials, and the tempo of the songs.

The CD's made for week one were increased via increments of five beats per minute for each of the next two weeks (ex. 120 wk. 1, 125 wk. 2, 130 wk 3). The researcher came to track practices at least 30 minutes early in order to organize the CD

players and insert the designated CD's for each subject . It was very beneficial to have the experimental group's subject number and initials on the CD's. This made it easier to identify the subjects both in the beginning of the study and throughout the process.

Data Collection

When the athletes in the experimental group received their CD's for week 1, they were allowed to run the 400 meters with their music so they could internalize the tempo and understand what was expected of them during this research project. During the second and third week, the athletes were only allowed to listen to their music while they stretched. The stretching took place before practice. After the athletes stretched, they were timed to see if they were internalizing the new tempo and decreasing their time while running 400 meters. The athlete's were timed after listening to their CD's. These times were recorded and then the selected music for the next week modified.

CHAPTER 4

RESULTS

Figure 1 shows graphed results of running times. During the first week, the baseline was recorded for 400 meters rate. Week two (the first week the athletes were allowed to listen to their music) was for the purpose of familiarizing themselves with the pace to which they were to run. During this time period, the athletes ran their 400 meters while listening to their music.

Week three revealed slower times for the experimental group. During this week, the athletes on the cross-country team ran in a meet the previous weekend. When the team returned, they appeared sluggish. The coach was concerned about the team's energy level after the meet and wanted them to do their 400 meters with less intensity. Because of this, the cross-country team ran slower in order to recover from the meet the previous weekend. When the researcher talked to the coach, he stated that everyone ran a personal record at the meet, but they were showing signs of fatigue from the meet and traveling.

By week four, the experimental group had again decreased their times on the 400 meter times. Those in the control group slightly improved their times over the four week period.

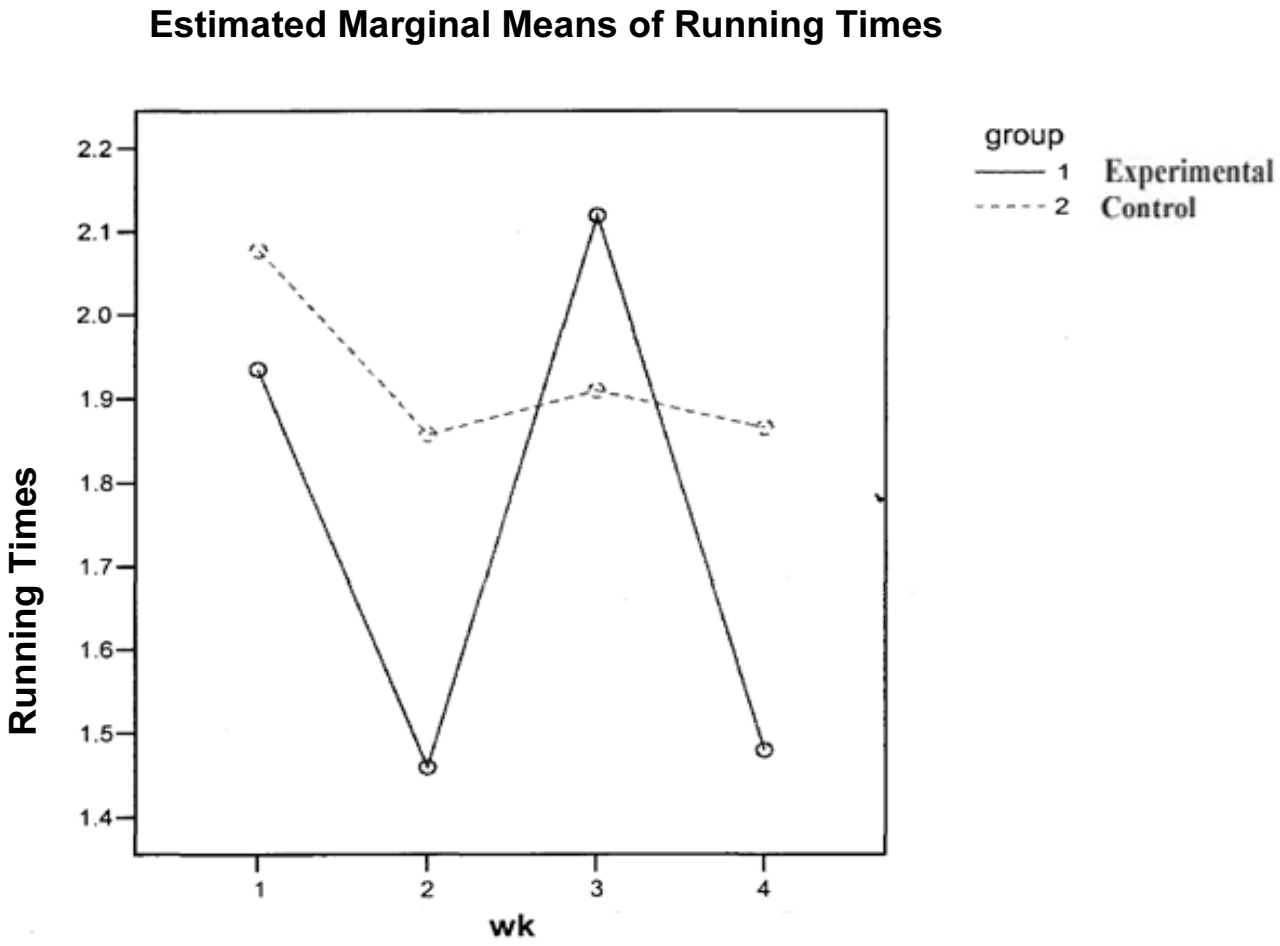

FIGURE 1

MONDAY

Music Questionnaire Results

Everyone that agreed to participate in the study was given a music questionnaire. This provided information about the preferred music of all the athletes. The results of this questionnaire are combined for all subjects, both experimental and control groups.

Table 2 Music Questionnaire Results

Classical	3	(11%)
Jazz	4	(15%)
Rock	3	(11%)
World Music		(0%)
Religious	10	(37%)
Reggae	7	(30%)
Rap	16	(59%)
Rhythm & Blues (R&B)	18	(67%)
Alternative	4	(15%)

To the question "what do you prefer to listen to while getting ready for track practice or a meet?", many athletes cited individual artists. Their answers included:
Lil' John (Rap), Linkin Park (Alternative), Tupac (Rap), Shirley
(Gospel), Nelly (Rap), Yolanda Adams (Gospel), Rap, R&B, Gospel, Classical, old school R&B, Jazz, Blues, Reggae, Neosoul, Religious, Metallica, Nelly (Rap), India Arie and Jill Scott (Neosoul). *Many of the athlete's answers were duplicated by others.

Table 3 shows the results of satisfaction with music questionnaire. The experimental group answered the questions to this questionnaire since they listened to the music. The mean ratings to these questions are as follows:

Question	Mean Rating
1. Do you feel practicing with your preferred music at a specified tempo assisted you in achieving the required times?	3.9
2. Do you feel that you have improved with your pacing?	4.0
3. Has using the tempo in the music to pace your running changed the way you feel about pacing with the times being called out?	3.5
4. Would you recommend this being used for all pace workouts?	3.7

The experimental group felt strongly that they improved their pacing. This was the highest mean rating score on the questionnaire (4.0). The lowest mean rating score was on the question if using the tempo in the music to pace running changed the way you feel about pacing with the times being called out (3.5).

CHAPTER 5

DISCUSSION

The results of this study are promising in that running times decreased across time. The question arises as to how a coach would implement use of this technique during workouts. It is apparent that staff would need to provide the fine details involved with this study. If the coaches had a music therapist on staff who was able to gather the musical selections of the athletes and then convert them to their running pace it would be helpful.

Some coaches might want to have a set tempo for specific distances for the track team to run. For example, 200 meters might be set to a certain tempo (fast) with 400 meters set to a different tempo (slower). When the athletes filled out the survey after the study, more than half of them recommended that this strategy be used for their pacing workouts. Each one of the subjects that were in the experimental group preferred to keep practice with the music that was sped up than to have the music at normal tempo.

During this study the subjects involved in the experimental group appeared more focused while listening to their music on head phones. By observation, the people involved in the control group and those athletes who were not involved in the study were off task more often. Those who were not a part of the experimental group would talk with their friends and perform their stretching haphazardly. Athletes who warm-up and stretch without taking it seriously can cause themselves great harm.
Also, an injured athlete can hurt the entire team. If the athlete is on a relay team or the team needs points to win a meet, that injured athlete could make the difference between the team winning or losing.

When conducting this research project, some difficulties came up.
When collecting the baseline for each athlete who participated in the study, it was difficult keeping up with all of the subjects participating in the project.
Learning new names, keeping track of those who completed the 400 meters, and getting it all recorded in order to modify the athlete's music was a challenge. By trying to collect the baseline alone without really knowing the subjects, the researcher became concerned about the accuracy of the information. The researcher decided to repeat the

process.

On the second time the researcher gathered the baseline information, assistance was received from the assistant coach. The same stop watch was used by the assistant coach as by the researcher which allowed records of six athletes to be recorded at the same time. This increased accuracy and was a better procedure.

This research can be transferred to many other sports. The sports may include swimming, cycling, running, jumping (long jump, high jump, etc.), and gymnastics. This technique can give athletes another choice when it comes to working on their pacing, speed, or focus.

With the enthusiasm and participation of the athletes and coaches expressed, the results of this study were considered successful. The cross-country coach asked the researcher for additional CDs for the rest of the cross-country team members. By the end of the study the athletes who were in the experimental group appeared to separate themselves from the team while preparing for practice and enjoy the CD to the extent that they did not want to part with them once practice began. Not only did the cross-country coach want CDs made for the team members, he also wanted a CD made for him for he still practices for up and coming competitions. The researcher was very pleased with the feedback expressed by the team. One of the athletes stated to the researcher that by having the music provided by the study, it assisted her in getting through those hard practices.

Further research on this topic can be beneficial to the music therapy, psychology, and athletic world. With extended research on this subject, a bridge could possibly be created to link these three worlds to better assist athletes in their physical environment.

APPENDIX A

MUSIC QUESTIONNAIRE FOR THE TRACK ATHLETES

What musical style do you prefer? Please circle those that apply.

Classical Jazz Rock World Music Religious Reggae

Rap Rhythm & Blues (R&B) Alternative

What do you prefer to listen to while getting ready for track practice or a meet?

_____
_____
_____
_____

Who are your favorite artist and/or what is your favorite song? This may or not be something you associate with your sport.

_____
_____
_____
_____

APPENDIX B

SATISFACTION WITH MUSIC QUESTIONNAIRE

1. Do you feel that practicing with your preferred music at a specified tempo assisted you in achieving the required times? Scale

1 (not at all) 2 3 (neutral) 4 5 (a lot)

2. Do you feel that you have improved with your pacing? Why or why not?

1 (not at all) 2 3 (neutral) 4 5 (a lot)

_____
_____
_____
_____
_____

3. Has using the tempo in the music to pace your running changed the way you feel about pacing with the times being called out?

1 (not at all) 2 3 (neutral) 4 5 (a lot)

4. Would you recommend this being used for all pace workouts?

1 (not at all) 2 3 (some cases) 4 5 (all the time)

APPENDIX C

RUNNING TIMES FOR EACH SUBJECT

EXPERIMENTAL GROUP

Subject	Gender	Baseline	Week 1	Week 2	Week 3
1	M	1.40	.71	2.03	.72
2	M	1.40	.73	2.04	.71
3	M	1.40	.72	2.03	.72
4	F	1.40	1.30	2.08	1.25
5	F	2.00	1.32	2.08	2.15
6	F	2.22	2.19	2.20	2.20
7	F	2.37	2.35	2.20	2.15
8	F	2.36	2.20	2.18	2.12
9	M	2.47	.72	2.03	.72
10	M	1.40	.71	2.03	.72
11	F	2.27	2.28	2.28	2.10
12	F	2.27	2.28	2.25	2.20

CONTROL GROUP

Subject	Gender	Baseline	Week 1	Week 2	Week 3
1	M	2.00	.74	2.00	2.05
2	F	2.20	2.30	2.28	2.27
3	F	2.00	1.32	1.40	1.26
4	M	1.40	.74	.74	.72
5	M	1.40	.74	.74	1.50
6	F	2.20	2.20	2.20	1.56
7	M	2.10	2.09	2.00	2.00

8	M	2.40	2.36	2.00	2.10
9	F	2.50	2.47	2.47	2.42
10	F	2.20	2.10	2.10	2.07
11	F	2.20	2.12	2.20	2.22
12	M	2.10	2.10	2.00	2.08
13	M	2.10	2.09	2.12	2.15
14	F	2.30	2.30	2.30	2.32
15	F	2.20	2.20	2.09	1.27

APPENDIX D

INFORMED CONSENT FORM

INFORMED CONSENT FORM

I freely and voluntarily and without element of force or coercion, consent to be a participant in the research project entitled "The effects of stressed tempo music with track athletes in order to increase their performance time."

This research is being conducted by Jennifer R. Brown, who is a student at Florida State University. I understand the purpose of her research project is to better understand track runners' training practices. I understand that if I participate in the project I will be asked questions about my preferences of music and pre-practice and competition rituals.

I understand I will be asked to fill out paper and pencil questionnaires. I may also be asked to run in order to collect data for this project. I understand my participation is totally voluntary and I may stop participation at anytime. All my answers to the questions will be kept confidential to the extent allowed by law and identified by a subject code number. My name will not appear on any of the results. No individual responses will be reported. Only group finding will be reported.

I understand there is a possibility of a minimal level of risk involved if I agree to participate in this study. I might experience anxiety when asked to run in order to achieve specific times. I am also able to stop my participation at any time I wish.

I understand there are benefits for participating in this research project. First, my own awareness about my practice techniques and to also see if there is something out there to improve my track performance. This knowledge can assist them in providing health services that help women stay as healthy as possible.

I understand that this consent may be withdrawn at any time without prejudice, penalty or loss of benefits to which I am otherwise entitled. I have been given the right to ask and have answered any inquiry concerning the study. Questions, if any, have been answered to my satisfaction.

I understand that I may contact Dr. Jayne Standley, Florida State University, and School of Music, (850) 644-4565, for answers to questions about this research or my rights. Group results will be sent to me upon request. You can contact Jennifer R. Brown at jmonie5@aol.com for any further questions referring to this research project.

I understand that if I have any questions about my rights as a participant in this research, or if I feel I have been placed at risk, I can contact the Chair of the Human Subjects Committee, Institutional Review Board, through the Vice President for the Office of Research at (850) 644-8633.

I have read and understand this consent form.

_____ _____

(Subject) (Date)

APPENDDIX E

APPROVAL FORM

Florida State
UNIVERSITY

Office of the Vice President For Research
Human Subjects Committee
Tallahassee, Florida 32306-2763
(850) 644-8633 · FAX (850) 644-4392

APPROVAL MEMORANDUM

Date: 10/5/2004

To:
Jennifer Brown
1572 Marcia Ave
Tallahassee Fl 32310

Dept.: **MUSIC SCHOOL**

From: **John Tomkowiak, Chair** John Tomkowiak M.D.

Re: **Use of Human Subjects in Research**
The effects of stressed tempo music with track athletes in oreder to increase performance time

The forms that you submitted to this office in regard to the use of human subjects in the proposal referenced above have been reviewed by the Human Subjects Committee at its meeting on **9/8/2004**. Your project was approved by the Committee.

The Human Subjects Committee has not evaluated your proposal for scientific merit, except to weigh the risk to the human participants and the aspects of the proposal related to potential risk and benefit. This approval does not replace any departmental or other approvals which may be required.

If the project has not been completed by **9/7/2005** you must request renewed approval for continuation of the project.

You are advised that any change in protocol in this project must be approved by resubmission of the project to the Committee for approval. Also, the principal investigator must promptly report, in writing, any unexpected problems causing risks to research subjects or others.

By copy of this memorandum, the chairman of your department and/or your major professor is reminded that he/she is responsible for being informed concerning research projects involving human subjects in the department, and should review protocols of such investigations as often as needed to insure that the project is being conducted in compliance with our institution and with DHHS regulations.

This institution has an Assurance on file with the Office for Protection from Research Risks. The Assurance Number is IRB00000446.

cc: Jayne Standley
HSC No. 2004.620

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Major: Music Therapy
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