Music and Rowing:
The Effects of Genre, Familiarity, and Preference

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Spring 2012

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Précis

Competitive athletes have steadily improved in ability and performance over the history of athletics. Sports theorists, however, have asserted that there is a final limit of human endurance and exertion, and that it is fast approaching. When the limit is reached, significant improvements in speed and scoring records will cease to appear. The theorized limit of physical potential is creating an environment in which athletes are hurrying to be the first in their sport to post what could be the final record. In this competitive environment, athletes and coaches are constantly looking for training enhancers that can help them achieve this goal.

Music is an ergogenic performance enhancer, with different genres providing different training benefits. This study was designed to examine which aspect of music (genre, familiarity or personal preference) provides the greatest increase in rowing ability during indoor rowing training. Four separate genres (instrumental and lyrical death metal, and instrumental and lyrical electronic music) were examined, as well as two musical treatments that examined familiarity and preference with the music (one treatment selected from a listing of popular songs, one treatment selected by a democratic vote from the subjects). In the end, the familiarity and preference treatments produced a significant increase in rower power output, whereas the four musical genre treatments did not, suggesting that varying the genre of music played during indoor rowing training will not make a significant increase in training benefit, whereas deliberately selecting music that the rowers know and enjoy will.

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Introduction

In the field of athletics, scores receive a lot of attention. Men and woman are continually categorized, judged, and ranked on the number of points they can score or the speed at which they can race. Training methods, aides, and enhancers are constantly being improved in order to give athletes the advantage that they need to push the boundaries even farther. Some experts, however, insist that there is a performance plateau waiting in the near future, after which no one will be physically able to break the existing records. During a symposium with the British Medical Association, Dr. Adolphe Abrahams insisted that the limits of physical exertion were "very close to present records and that further improvement was unlikely" (B.M.J.). If he is correct, then not only are athletes close to establishing these physical limits, but a race to achieve them, in which each athlete competes to be the original holder of the record, is likely to ensue.

Steroids are illegal in the athletic world because they constitute an unfair advantage, not only against other athletes, but also against every athlete that has come before a steroid user. Colloquially, it is said that any scores or records that came after the legalization of steroids would have to have an asterisk after them, since they would recognize a shift away from utilizing the limits of natural human endurance as the standard in athletic performance (Brooks and Brooks 53). Since chemical enhancements are illegal, coaches and trainers are currently looking for the best ways to maximize the performances of their athletes without compromising the integrity of their sports (Cronin).

Music is very common in training facilities. Many athletes find that it creates a positive distraction from the difficult effort of athletic training (Brooks and Brooks 54). Recent research is beginning to analyze whether or not certain types of music produce significant increases or decreases in athletic performance (Reynolds). Many coaches have commented that playing the

right music creates a noticeable increase in an athlete's psychology and attitude towards a workout. At this point in time, music is classified as an ergogenic aid that can create a legal increase in training benefit and advantage as an alternative to illegal substances like steroids (Brooks and Brooks 52-57).

The magnitude of the training benefit is not constant across all sports and all genres of music. Different sports require different types of effort, and different genres of music have been found to maximize the increases in these efforts. Since listening to music during actual performance may cause a distraction from the important environmental cues of an individual's sport, it is important to capture the benefit as quickly and efficiently as possible during training. Pure endurance sports, such as running, cycling, and cross country skiing, require a prolonged effort over an extended period of time with prodigious control of bodily movement and muscle exertion (Colberg). Previous research on musical benefit during endurance sports has found that the ideal music to enhance training benefit is steady music with a consistent beat (Szabo, Small, and Leigh 220-225). Music that falls into this category includes but is not limited to electronic, techno, and dance music. By contrast, sports that favor explosive power and strength over short exertions, like football and competitive weightlifting, benefit from songs that foster aggressive feelings (Coss). Musical genres like hard rock and death metal have been found to create an ergogenic ability to increase power output and performance in these power sports.

Rowing falls into a special category between endurance and power sports, which is appropriately called power endurance athletics (Colberg 204). Rowers practice and race for extended periods of time over distances that typically vary between two thousand and ten thousand meter long races. Training itself can often last for extremely long rows that might take over an hour and cover a distance greater than a marathon. Though the act of rowing is long and

tiring like many endurance sports, at the stroke-by-stroke level it is very similar to a repeated squat and row motion that is found in weight training and power lifting. In addition, rowers are often required to increase their power output during “moves” that last for ten or more individual strokes in a race, designed to allow the rowers to jump a short distance ahead of a boat next to them. After a power piece, rowers are immediately required to assume the same level of effort as before. Thus, even though rowing requires stamina and cardio endurance, it also clearly involves the power and strength demands that qualify it as a demanding power sport.

With its combination of endurance and power demands, the genre of music that will benefit rowers during strength and conditioning training is not readily apparent. The only clear lines are drawn during cross training, such as cycling or weight lifting, that are designed to provide a helpful workout without over-training or stressing the muscles that are typically worked during the season. During the actual act of rowing, it is difficult to say definitively whether or not it is the endurance or the power aspect of the sport that benefits the most from the ergogenic benefit of music.

In addition, the personal preference of the athletes may play a significant role in practice benefit. Repetition causes boredom, which can negatively influence training when people cease to give their full attention to the sport and begin to lose the technique benefits of training, or even the conditioning benefits due to apathy and unwillingness to give a whole effort (Scott et al). Rowing at the competitive level is a very painful activity, and can sometimes cause physical conditions such as lactic poisoning when people are exceeding their physical limitations in the name of training (Huntsman). To counteract this, finding music that people enjoy can foster a positive attitude that can increase performance when the pain becomes too significant to perform under normal circumstances (Scott et al). Because of this, finding a musical style that athletes

thoroughly enjoy may be as beneficial as finding a genre that is scientifically proven to provide an ergogenic enhancement.

In the world of competitive rowing, the limits of physical exertion are every bit as real as they are in other sports. The question of what is more beneficial, the genre of music that is played during training or an athlete's preference for individual songs, is one that should be addressed within the sport and resolved quickly, so that the full athletic benefit can be achieved and the rowers can reach their fullest potential.

Hypothesis

1: Varying the musical genre during indoor training will create a significant difference in power output during a series of repeated short, lactic acid rowing exercises.

2: Rower power output will vary over a series of musical treatments during indoor lactic acid training as a function of the individual rower's preferences for the music that is played.

Null: There will be no difference in rower power output during an indoor training session with musical treatments, regardless of the genre of music and a rower's individual preference for or against it.

Materials and Methods

Sample

The sample for this experiment was drawn from members of the Washington State Men's Crew Rowing team. Only members of the Men's team were considered, even though the Women's Rowing team has exceptional rowers. Because the Women's team is under NCAA

jurisdiction, which puts a limit on the amount of time that they are allowed to train and practice, they would not be able to commit to extra rowing sessions for the purpose of an experiment.

The Men's team is split into two separate groups: the Novice and Varsity squads. The Varsity squad is made up of rowers and coxswains who have spent at least six months on the team, during which they have participated in a spring racing season. The implication behind Varsity status is that the rowers have enough experience to understand the strenuous requirements and mental taxation behind most rowing practices. Using Novice rowers, who are less experienced, may create an experimental confound due to the novelty of certain rowing workouts and their relative inexperience to the sport. Because of this, only Varsity rowers were asked to participate in the experiment.

Arthur Ericsson, the head Coach for the Men's team, agreed to make the experiment a part of the team's winter training sessions, so that the sample size could be maximized. Winter training takes place during the months of November, December, and January, when it is too cold to safely practice on the water. It typically takes place indoors on a fleet of rowing machines, designed to measure the power behind each stroke. The availability of the squad during winter training prevented the need to ask for volunteers who would be willing to participate in an after hours research project. Such a requirement could have potentially reduced people's willingness to participate, and could have introduced a confound if people were participating after doing the normal workout, which would have varied in intensity and potentially fatigued the members before they began the research. Unfortunately, this meant that the sample was not gathered on a volunteer basis, which might have affected people's willingness to cooperate, the majority of varsity rowers are already very used to strenuous requirements for their practices that often

challenge them physically and mentally. Being asked to do an experiment that falls within the usual requirements of rowing practices is entirely manageable for them.

The sample was made up of twenty-two rowers on the WSU Men's Crew Varsity squad. Ages ranged from eighteen to twenty-seven, with the average age being twenty-one. Rower experience ranged from only one year as a rower up to six years of experience. Each of the rowers was familiar with the use of a Concept 2 Rowing Ergometer, and has participated in workouts that require them to use one for at least one year, making them already familiar with the main portion of the experimental apparatus.

Apparatus

The research made use of the WSU Men's Crew team training facilities in the Hollingberry Fieldhouse conditioning center. The team has a fleet of Concept 2 Rowing ergometers, all of which are either in the model C or D edition. The differences between the two models are minor: in the Ds the average wattage pulled over a power interval is not broken down to the decimal level, the monitor does not allow for a "rolling start" (in which the air flywheel is spinning before the first stroke, which causes the first stroke to be read at a higher power output than it is), and the average strokes per minute cannot be taken until the end of the session.

The typical measure of power output and speed on a rowing ergometer is the "split", which is a time reading that displays how long it would take the rower to move five hundred meters at their current pace. Unfortunately, splits are difficult to process at a statistical level, so the research examined the average wattage that rowers produced instead. All of these scores were collected automatically and archived by the computer monitors on the ergometers. After each interval, the coxswains examined each machine and collected the necessary scores.

Initially, the goal of this research was to examine the effects of music on both long, aerobic endurance training and on shorter lactic acid training. However, the reality of asking a nationally ranked team to dedicate a period of time for independent research made this difficult. Instead, only short lactic acid training was examined, as it allowed for much shorter and more intense workouts that do not require as much of a time commitment.

The lactic acid training took place over six sessions, each made up of twelve forty-five second intervals that had three minutes and forty-five seconds of rest in between them. Though the effort requires heavy cardio-vascular endurance and strong aerobic ability, this training qualified as anaerobic lactic work that tests and trains high rate power output as opposed to the ability to maintain power output over longer periods and lower rates (Thomas). In theory, with the ample rest, rowers should have been able to perform at nearly one hundred percent of their power ability with every interval, approaching their maximum speed capabilities every time. It should be well within the rower's capabilities, regardless of any outside variables such as illness or small injuries. Because of this, any increase or decrease in power output should be solely due to the independent variable, and not due to an environmental confound.

Two of the experimental sessions used death metal music. Death metal is characterized by heavily distorted instrumentation, low growling vocals with often violent and aggressive lyrics, and blast beat drumming, minor keys, and complex song structuring (Randel). Previous research has suggested that metal produces a psychological effect that increases the aggressiveness of athletes, causing an increase in power output (Coss). This may be related to the aggressive and intense nature of the lyrical content, and because of this, both instrumental and lyrical death metal music will be examined.

Another two sessions will use electronic music. The defining characteristic of electronic music is its namesake: a heavy or complete emphasis on electronically synthesized sound, which has very specific timbre and characteristics (Randel). In addition, however, many electronic songs have consistent beats and repetitive sound, in contrast to the complex and varied sound structure in death metal. This music falls into the category mentioned early in the introduction that may cause a significant increase in an athlete's ability to perform over long endurance pieces. Like metal music, electronic music has been divided into both instrumental and lyrical subgenres for the purpose of the study.

It is possible that familiarity with music, both at a song and genre level, may have an effect on rowing ability. The easiest way to select for familiarity of music is to choose popular songs. One of the musical treatments in the study will be selected from the Billboard Top 100 list. The list is a comprehensive database that puts all of the currently top rated songs in the music industry ranked from one to one hundred (Billboard.com). By taking a selection of songs from this collection, it is likely that a majority of the rowers will have heard them before, which is not necessarily the case with the other genres.

Personal preference is another factor that could significantly change how music affects a workout. The easiest way to control for this is to add an interval session in which the rowers select the music that is played. For the study, each rower was allowed to nominate one or more songs that he wanted to hear during the workout, after which each one was presented with a database of all the available songs, each with an audio sample. After that, the songs were compiled into a playlist based on how many votes each one received. It was assumed that letting the rowers choose the music they wanted to listen to would create a treatment composed primarily of music that they would prefer, as a group. In order to test whether or not this was

true, a post-treatment self-report survey was provided, which invited the rowers to describe whether or not they enjoyed the music that was played.

The surveys used a Likert-Like scale for all answers, which gives the option of circling a number between one and five to indicate the accuracy of a statement, where one means “disagree strongly” and five means “agree strongly” (Gravetter). Three survey questions inquired whether or not the music helped to distract the rowers from the pain of the workout, two asked whether or not the music distracted them from concentrating on their performance and output, three asked whether or not the music was familiar to them or similar to their personal musical tastes, and three asked whether or not they liked the music that was played during the treatment. In addition, rowers were given space to provide any additional comments that they had about the music, its effect on them, and how it improved or hindered their performance.

Procedure

The study made use of a functional design, making use of an ABAB design model. Each of the six experimental sessions has a control (A) and treatment (B) interval built into it. Of the twelve intervals, the odd numbered intervals had no musical treatment, while the even numbered intervals had a musical treatment meaning that instead of looking for variations between treatment sessions versus a single control session, half of the session is compared to the other half. This is the only practical way to test with a group of student athletes who have multiple schedules that need to be coordinated.

Each experimental session began with an identical warm up session on the rowing machines. Rowers prepared themselves for twelve minutes under the direction of one of the coxswains. The warm up began with a drill emphasizing the appropriate sequencing of the

rowing stroke. After that, rowers began a ladder interval, in which they gradually increased the rate and pressure of their rowing, a few minutes at a time. The warm up ended with some powerful start pieces, which are designed to simulate the first few strokes off the starting line in a race. They are powerful, short, high rate intervals that are very relevant to the type of high rate work in the experiment. At the end of the warm up, Coach Arthur gathered the rowers to refocus them with a short speech on the type of work that they need at this point of the season, the importance of high rate work, and a reminder of the current team rankings to entice each rower into giving his all.

The conditioning center is outfitted with several speakers around the perimeter of the room, allowing for a surround sound system. Before the first experimental session, the speaker volume was adjusted to an identical level, ensuring even sound to all of the rowers, which was controlled for throughout the entirety of the experiment. Unfortunately, due to the nature of the music industry, some songs are recorded at higher volumes than others, in what is called the "loudness war" (NPR.com). This means that even though the speaker and amplifier volume was kept at a controlled rate, some songs were still louder than others, but unfortunately this extraneous factor could not be controlled for.

The first interval in each session had no music. The rowers performed the forty-five second piece, and then the three-minute and forty-five rest period began. Halfway through the rest period (at roughly one minute and fifty seconds in) the first of the session's songs was played through the speaker system. The music continued playing for the remainder of the rest period, through the interval, and then into the following rest period. At one minute and fifty seconds into the next rest period, the song was turned off for the next control session. This pattern continued throughout the entirety of the session. The purpose of having the songs begin

and end partway through the rest period of each session was to provide even dispersal of music and no music through the session.

Qualitative observations were taken of the rowers throughout the experimental session by the primary researcher. The data was gathered primarily through notes on what the rowers said, did, and how they behaved during each of the treatment and control intervals. By examining the rower's expressions, interactions, and habits during the rowing pieces, an additional insight could be provided about what effect the music is having throughout the workout. While is it not statistically powerful data, it could at least point the way for future research in the area.

Results

The first step in running data analysis for the experiment was to find a workable sample. Though the sample was made up of twenty-two rowers, the reality of training injuries, academic schedules, and an unfortunately timed flu season kept some of the rowers from making all of the sessions. The lowest number of rowers that ever attended a session was twelve, and thus the sample size was reduced to twelve. Participants were excluded from the data analysis based on the number of sessions that they were able to attend, so that the twelve participants in each of the analysis clusters represented the rowers that attended the most experimental sessions, even if they were not the same twelve in each session. Only seven of the rowers were able to attend every experimental session. The other five all attended three or more sessions, and the remaining few who attended less than three were excluded. This helped to control for familiarity with the workout that the experiment used.

To account for the reduced sample size and the combination of rowers who made all of the sessions and rowers who made every session, a mixed-design analysis of variance was used

to examine the information. In a mixed-design ANOVA, analysis is done as both a within-group experimental design (in which one group of subjects experience a variety of experimental treatments) and as a between-group experimental design (in which different groups of subjects experience the same experimental treatment). For the purpose of data analysis, the within-group variable for this study was the presence or absence of music during the workout, fulfilling the control and treatment requirements of the functional design study. The between-group variable was the six different musical treatments. Even though some of the rowers were able to attend all of the sessions, not everyone was, and thus the treatments were treated as six individual groups, although within each session, all twelve rowers received the same musical treatment.

The data was processed using IBM's SPSS (the Statistical Package for Social Sciences). The main effect for our within-subjects variable (the presence or absence of music) was nonsignificant ($F(1, 66)= .117$, $p=.734$, $P>.05$). This suggests that during short, lactic acid training such as the forty-five second intervals used for the experiment, playing music does not create a significant increase in the average wattage output by the rowers.

The main effect for our between-subjects variable (the music type) was also nonsignificant ($F(5, 66)= .174$ $P=.971$, $P>.05$). We were not able to detect a significant increase in the average wattage output between the six musical treatments that were presented to the sample.

Finally, the main effect for the interaction between the two variables (music type and its presence or absence) was nonsignificant ($F(5, 66)= .777$ $P=.570$, $P>.05$). This suggests that adding specific genres of music throughout the workout does not create an increase or decrease in the average wattage produced by the rowers.

Though we were unable to detect a significant wattage increase when the music was played and manipulated throughout the workout, the survey data remained as a possible insight into the source and explanation of several qualitative observations of changing behavior from the rowers during the musical treatments. When presented with the metal treatments (both lyrical and instrumental) the rowers became introverted and ceased to interact with one another. In addition, they showed resistance towards resuming the workout at the end of the rest period. By contrast, during both electronic sessions as well as during the familiarity and preference treatments, they were talkative and interacted frequently with one another. While there may be various psychological roots for this behavior, we decided to apply our survey data to see whether or not we could explain it with the music's effect on their distraction from pain, their distraction from their performance, or from their self-reported familiarity and preference for or against the treatments.

The main effect for music type's ability to distract from the pain of rowing was nonsignificant ($F(5, 66)=.780$ $P=.568$, $P>.05$). This implies that none of our musical treatments was able to create a significant distraction from the pain of rowing, as perceived and reported by the rowers.

The main effect for music type's ability to distract from rowing performance was also nonsignificant ($F(5, 66)=1.231$ $P=.305$, $P>.05$). This implies that none of the music types that we examined creates a significant enough distraction for the rowers to keep them from concentrating on how well they are rowing.

The main effect for the rower's familiarity with each of our six music types was nonsignificant as well ($F(5, 66)= 1.489$ $P=.205$, $P>.05$). The rowers were not more or less familiar with any one of the six music types over another.

Finally, the main effect for the rower's preference for or against the musical treatments was nonsignificant ($F(5, 66)= 1.260$ $P=.292$, $P>.05$). Of the six music types, the rowers did not significantly prefer one over another.

Discussion

From this analysis, it appears that neither the presence nor type of music played during workouts contributes significantly to the average wattage output by rowers during short, lactic acid training. However, it is important to note several aspects of this research study that may have played a role in the production of this data.

Statistical power refers to the likelihood of a study to produce statistically significant results. In general, the easiest way to increase statistical power is to increase the sample size of an experiment (Gravetter). While the study began with a sample of twenty-two rowers, these numbers were reduced by almost fifty percent during the statistical analysis. Working with such a small sample size heavily reduced the power, and thus may have played a role in our inability to reach statistical significance.

In addition, the purpose of using extremely short, lactic intervals was to provide a workout environment in which the rowers would be able to perform at nearly one hundred percent effort for every interval. The side effect of this is that differences between the control and treatment intervals may have been minimal due to the mental conditioning of the athletes, who are trained to ignore many environmental distractions during workouts in order to maximize their performances. The musical treatment's failure to achieve statistically significant differences in distraction from rowing performance may support this assertion.

Rowing training, like many endurance workouts, can include for extended exertion periods lasting more than an hour (Gravetter). During indoor training, the rowers will be sitting on ergometers, looking at nothing other than the computer monitors in front of them for the extent of these workouts. In a situation like this, the psychological distraction that music can provide may become more profound. Previous research has found that matching up musical tempo with an athlete's heart rate over extended endurance training periods like this can contribute to the athlete's ability to give consistent effort over the long period (Karageorghis). As a future direction of research, it may be beneficial to examine the effect of musical treatment's on indoor rowing endurance training. Over an endurance workout, there is more time for profound differences in power and distance averages to manifest, which may give us more statistical data than our research with short, lactic workouts did.

Though they did not produce significant quantitative differences in their effects on rowing ability, the musical treatments in the experiment did produce interesting qualitative effects throughout the research.

Metal music, both instrumental and lyrical, was postulated by previous research to improve athletic aggression, which should have increased power output. Based on supplementary comments that the rowers made on their surveys, both Instrumental and Lyrical Metal did increase aggression. Rowers left comments like "very aggressive" and "intense!" but they did not produce more power, as reflected by the relatively low average split scores in the data. Instead, the aggression manifested in the attitudes that rowers presented during the rest period of the workouts.

During ergometer workouts with long rest periods, it is not unusual for rowers to get up for a few minutes off the rowing machines and move around to stretch out their muscles and

pump some of the lactic acid away. During this time, it is common for them to interact with one another (assuming the rest is long enough for them to catch their breath and restore a little bit of energy). Typically, they will either joke about the difficulty of the workout, try to distract one another from the discomfort, check on a rower who seems to be having a difficult time, or compare their current power outputs. During both metal sessions, however, they instead became introverted, moving around with their heads down, making no effort to joke or talk with one another, and presenting some hesitation and resistance when prompted by the coach and coxswains to resume paddling in preparation for the next piece. In general, even though they did not produce more power during the rowing, instrumental and lyrical metal music seemed to damage the rower's attitudes and make them have a tougher time completing the workout psychologically. This psychological effect could be related to increased pain as a result of the attitude that the music communicated. Research with postoperative surgery patients has suggested that different listening to music can affect perceived pain (Vaajoki). Though the rowers did not report significantly heightened pain during metal music treatments, this could be another result of their athletic conditioning and the fact that they do not want to admit to heightened pain sensations.

By contrast, both instrumental and lyrical electronic music seemed to improve rower's attitudes and make them more positive throughout the workout. After the session, many of the rowers went out of their way to comment that they liked the music, and requested that it be added to the actual workout playlist that is used for the rest of the team's indoor training regimen. They commented on the music, talked and joked with one another, danced and head-bobbed along during the rest periods, and compared their scores with one another throughout. Even though it wasn't particularly effective in increasing their power output, it appears that

electronic music helped rowers improve their attitudes about approaching and finishing the workout.

In general, this experiment took several serious hits because of the reduction of its sample size for data analysis and because of the limited sessions that could be feasibly conducted without interrupting the team's training schedule. There may be confounds such as order effects among the songs, variations in athletic ability between rowers, and the rigors of their academic schedules that can only be controlled for with repeated testing and a larger sample size. While this experiment is not definitive, it provides a starting point for further studies to determine how rowers can get the best ergogenic effect from their training music.

Appendix A: Mixed-Design ANOVA Results

Descriptive Statistics

	Music_Type	Mean	Std. Deviation	N
Control_Wattage	1.00	410.6489	82.96989	12
	2.00	408.3208	74.12828	12
	3.00	408.2486	71.05002	12
	4.00	415.9333	69.82506	12
	5.00	423.3090	67.04131	12
	6.00	431.5097	67.85562	12
	Total	416.3284	70.28208	72
Music_Wattage	1.00	408.9403	71.18481	12
	2.00	411.5333	66.61440	12
	3.00	412.7417	66.46824	12
	4.00	420.0833	70.85536	12
	5.00	417.6036	66.94183	12
	6.00	430.8903	71.08821	12
	Total	416.9654	66.82407	72

Tests of Between-Subjects Effects

Measure: MEASURE_1

Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Noncent. Parameter	Observed Power[a]
Intercept	24997629.190	1	24997629.190	2536.632	.000	2536.632	1.000
Music_Type	8594.693	5	1718.939	.174	.971	.872	.088
Error	650407.176	66	9854.654				

Tests of Within-Subjects Contrasts

Measure: MEASURE_1

Source	Music_Present_Absent	Noncent. Parameter	Observed Power
Music_Present_Absent	Linear	.117	.063
Music_Present_Absent * Music_Type	Linear	3.887	.262
Error(Music_Present_Absent)	Linear		

Tests of Within-Subjects Contrasts

Source	Music_Present_Absent	Type III Sum of Squares	df	Mean Square	F	Sig.
Music_Present_Absent	Linear	14.608	1	14.608	.117	.734
Music_Present_Absent * Music_Type	Linear	486.902	5	97.380	.777	.570
Error(Music_Present_Absent)	Linear	8268.170	66	125.275		

Appendix B: Survey Data

Distraction_Pain

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	7.903	5	1.581	.780	.568
Within Groups	133.750	66	2.027		
Total	141.653	71			

Distraction_Perf

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	7.333	5	1.467	1.231	.305
Within Groups	78.667	66	1.192		
Total	86.000	71			

Familiarity

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	8.778	5	1.756	1.489	.205
Within Groups	77.833	66	1.179		
Total	86.611	71			

Preference

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	12.778	5	2.556	1.260	.292
Within Groups	133.833	66	2.028		
Total	146.611	71			

Appendix C: Survey Questions

Survey on the interaction of musical genre and preference with rowing performance

For the following, please circle one of the numbers corresponding to each question, with 1 meaning **disagree strongly**, and 5 meaning **agree strongly**

I found that the music played during today's workout distracted me from the pain of rowing

1 2 3 4 5

I found that the music played today distracted me from my performance (splits, stroke rate, control, etc.)

1 2 3 4 5

I found that having no music during rowing was less comfortable than having the music that was played during this session

1 2 3 4 5

There was a difference in my concentration and awareness of the pain of rowing between when there was music and when there was not

1 2 3 4 5

There was a difference in my concentration and awareness of my rowing performance (splits, stroke rate, control, etc.) between when there was music and when there was not

1 2 3 4 5

For the following, please circle one of the numbers corresponding to each question, with 1 meaning **disagree strongly**, and 5 meaning **agree strongly**

I liked the music that was played today

1 2 3 4 5

The music that was played today is similar to the music that I listen to for leisure

1 2 3 4 5

I recognized the music that was played today. I am familiar with the artist

1 2 3 4 5

I have never before heard music that was similar to what we listened to today

1 2 3 4 5

When the music stopped playing, I became more aware of my exhaustion or pain

1 2 3 4 5

When the music started playing, I became distracted from my exhaustion or pain

1 2 3 4 5

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