CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Daniel E. Aguilar

Project Number
S1201

Project Title
Analysis of Caloric Usage and Cardiac Output Using a Variety of Exercises

Abstract

Objectives/Goals
The goal was to discover a quick, convenient way to burn calories to have a healthy lifestyle by evaluating the burning of calories through 5 different exercises.

Methods/Materials
The materials used were a stop watch, a journal, and a human subject.

The methods used were to: 1) take a resting heart rate; 2) do the exercise; 3) take heart rate again; 4) continue until all five exercises were completed.

Results
Each exercise showed a diffrent amount of burned calories. Some were greater then others.

Conclusions/Discussion
In the end, the exercise that burned the most calories was jumping jacks. When done for a longer amount of time it will show even greater results.

Summary Statement
To determine if the more extraneous the exercise, the greater the amount of calories can be burned.

Help Received
My friend performed the exercises for me.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Alexandria Barnum; Courtney Bishop; Emily Wright

Project Number

S1202

Project Title

Baby Boomers Bounce Back: The Impact of Practice on the Degenerative Effects of Aging

Abstract

Objectives/Goals

The purpose of this project is to counteract specific degenerative effects of age. The decline of mobility, visual motor skills, and reaction rates can severely inhibit the quality of life for the aged. Simple exercises performed on a weekly basis will measurably improve the reaction rates, balance, and hand-eye coordination of older adults.

Methods/Materials

Physical therapists were consulted in order to design activities that should improve balance, reaction rates, and hand-eye coordination. Eight tests were designed, and are listed as follows: The Timed Up and Go (TUG) test, the ten step heel-toe walk, the one leg stance test, the handwriting test, the bead stringing test, the bead translation to palm test, the ruler drop test, and a computer reaction rate test designed to measure reaction rates in milliseconds. Twenty-five test subjects age sixty and older were selected for this trial. Baseline measurements for the eight tests were collected. Participants were retested two more times in five weeks. Twenty of the subjects were the "practice group." The remaining five control subjects did not practice and were tested three times.

Results

Average percent differences from the practicing group to the control group are as follows:
Handwriting analysis- 19.9% improvement, bead stringing test- 7.9% improvement, bead translation to palm- 1.8%, heel-toe walk times- 16.02%, heel-toe missed steps- 36.9%, right leg stance- 12.6%, left leg stance-1.3%, TUG test- .91%, ruler drop-1.1%, laptop reaction times- 73.2%.
Visual motor skills improved 4.6% more in those who had practiced. Mobility/balance improved 15.5%, and reaction rates improved 36.1%.

Conclusions/Discussion

Every category addressed in this project improved with practice. The most dramatic improvement was observed in mobility. It is important to note that the active group improved in every test. Mobility (balance), visual motor coordination, and reaction rates can be measurably improved in geriatric patients.

Summary Statement

The purpose of this project is to observe if weekly practice of visual motor skills, mobility, and reaction rates can delay degeneration and improve geriatric subjects' ability to perform tasks involving these skills.

Help Received

Physical and occupational therapists at Antelope Valley Healthcare Center were consulted on test designs, Mother helped construct display board, Teacher and Mother helped during testing sessions.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Kelly R. Fitzgerald

Project Number
S1203

Project Title
Balance through the Ages

Abstract

Objectives/Goals
Which age group has the best balancing skills? Can participants improve their balancing skills after practicing over five days?

Methods/Materials
I used a stopwatch, a paper, and a pencil. I had participants stand on their right foot with their left leg by their right knee. Their arms should be out to the side with their eyes closed. I used a stopwatch to see how long they could hold this pose. They were instructed to do ten ankle raises, two times a day for five days. After five days, I tested the participants again to see if their balance has improved.

Results
People around twenty years of age have the best balancing skills. As a child, your balancing skills are still improving because your brain and your muscles are still developing. When you are twenty, you are at your physical peak of muscle coordination and strength. After age twenty, your balancing skills start to decrease because your vestibular function, strength, and muscle coordination all decrease.
Your muscles continue to develop coordination and strength up to age twenty. Your vestibular function is at its maximum at birth, and slowly decreases with age.
When you are twenty, your vestibular function will be at its highest, relative to your muscle strength. That is why your balancing skills are the best when you are twenty, and not any other age. This experiment also demonstrated that you could improve your balancing skills with practice within five days.

Conclusions/Discussion
My hypothesis stated that your balancing skills are the best when you are around twenty years of age. 21-25 year olds have, on average, a time of 307 seconds; their second time was 330 seconds. The next closest age group I have to that time was the 16-20. Their first time was 248.65 seconds, and their second time was 330.49 seconds. This proves that twenty year olds have the best balancing skills. Plus it is now proven that you can improve your balance within five days. Out of twenty-nine participants, only three of them did not improve their times, two of them got the same time. If I had to redo my project, I would separate the males from the females, because males and females could have different balancing skills.

Summary Statement
I was trying to find the age group with the best balancing skills, and see if the participants would improve within five days.

Help Received
My parents proof-read my summary and project.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Kevin T. Gunderson

Project Number
S1204

Project Title
The Light of Incidence: Does It Affect Mental Acuity?

Abstract

Objectives/Goals
This project was designed to determine if there is significant difference in the time of reaction rate between colors by taking two sets of tests, one reading and one multiplication. The objective of this project was to discover if a significant difference exists when different colored text are compared to the black control text

Methods/Materials
Each subject began my experiment by taking a Farnsworth 0-15 color test and a seeing eye chart test to determine the functionability of the subject's eye. Once the subject had completed both tests, I led them to the area were the testing was performed. First I measured the time it took for each subject to complete each reading test on the computer, four in all. Next I measured the time it took for each subject to complete four different multiplication tests. For each test subject I varied the order in which I administered each test by using my test order sheet. In my experiment I used a Farnsworth 0-15 color test, a seeing eye chart, 2 stopwatches, a computer, 385 sheets of paper, printer ink, pens and pencils, proper lighting, and a room with a desk and chair

Results
In my experiment, I discovered that none of my tests proved significant difference compared to the control test. What this means is that compared to the black tests, no other test was significantly faster. However, by comparring color tests to other color tests, i did prove significant difference in the times in which it took to complete the tests. This was the green reading compared to blue reading test, with a p value of .05 supporting that it is significantly faster to read in green compared to blue.

Conclusions/Discussion
My results did support my hypothesis in believing that the reaction rate of green would be faster than blue, due to the fact that a human contains more green recepting cones in their eyes than any other color. Cones that recieve blue light are least promenant in the eye, backing up my resutls. Future directions in which a can take this project include doing more testing in different shades of a color compared to different shades of the same color. With the knowledge of my results, any text that is written in blue can be changed to green to ensure fater and more complete reading of the test

Summary Statement
Determining if our eyes process information faster when basic visual tasks appear in different colors

Help Received
Used lab equipment owned by the Napa Eye Care Center; Instructed by Dr. Kerr

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Kendall E. Hayden

Project Number

S1205

Project Title

The Effects of Age and Gender on Skeletal Muscle Contraction

Abstract

Objectives/Goals

The objective was to learn if people of varying ages and genders produce muscle force differently, by using measures of muscle sound.

Methods/Materials

Subject 1 was instructed to sit in the dynamometer and an electrode was placed on the subject's vastus lateralis muscle on the thigh. The subject then contracted their leg with their maximum force and this was recorded. The subject was allowed to rest for two minutes, then asked to contract at an interval of 10%. After this number was recorded in a table, the process was repeated eight more times, at intervals of 20, 30, 40, 50, 60, 70, 80, and 90% in relation to their maximum force. Other numbers were extrapolated, if needed, to find the numbers that were not measured due to the subject's inability to contract close to the desired number.This entire process was repeated on subjects 2-5.

Results

There were different patterns of response for amplitude and frequency of sound. The adults had a much larger increase in muscle sound than the adolescents as the percentage of maximum force increased. Both of the groups, adolescents and adults, steadily increased the frequency of their waves as the intervals increased. The female and male subjects had a similar increase in the sound of their vibrations as the interval increased. The female group's frequency of muscle vibration decreased whereas the male group's frequency of vibration increased at each interval.

Conclusions/Discussion

In conclusion, adults rely more on motor unit recruitment to contract their muscles than adolescents. Also, adolescents rely slightly more on the frequency of their muscle vibration to contract harder, possibly due to underdevelopment in their nervous systems. Females and males have almost the same reliance on amplitude, as well as motor unit recruitment, despite their gender differences. Females increase vibration frequency to contract their muscles harder, while the males decrease their vibration.

Summary Statement

My project investigated the differences in muscle activation between adolescents and adults, using measures of muscle sound.

Help Received

Used lab equipment at Cal State Fullerton under the supervision of Dr. Jared Coburn; Mom helped by driving me to the lab

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Amir S. Kelly

Project Number
S1206

Project Title
How High Can You Go?

Abstract

Objectives/Goals
The objective of the experiment was to find out what temperature of water (room, warm, or cold) maximizes the vocal range.

Methods/Materials
Materials: 1. 7 singers; 2. 1 keyboard; 3. A pianist; 4. 2 minutes vocal warm ups; 5. 7 cups # 1 cup each; 6. 1 thermos of warm water at 130 degrees F; 7. 1 thermos of ice-cold water at 30 degrees F; 8. 1 thermos of room temperature water at 65 degrees F; 9. Log; 10.Pen/Pencil.
Method:
1. 2 minutes of selected vocal Warm ups. 2. Subject drank a cup of room temperature water & rested 1 minute. 3. Vocal test. 4. Test notes by playing keys on the keyboard. Start lowest to highest. Record the number of notes hit. 5. Repeat procedures 3-4 with next 6 subject. 6. Subjects drank cup of ice-cold water at 30 degrees F & rested 1 minute. Vocal test. Repeat procedure number 3-4. 7. Subjects drank a cup of warm water at 130 degrees F, repeat procedure 3-4.

Results
The results of this project were that the cold water minimized the vocal range because the vocal chords contracted and vibrated less. The room temperature was the control and kept the range at normal. The warm maximized the vocal range because the vocal chords contracted and vibrated freely.

Conclusions/Discussion
The conclusion of this experiment was that the hypothesis was proven to be correct when testing seven subjects. There wasn#t a large difference but the Vocal range was maximized when the singer drank warm water. The ice-cold water made the singers unable to hit higher notes, resulting in their voice cracking. Most of the singers were professionally trained to hit notes under any condition. I now know that warm water maximizes the range.

Summary Statement
The summary of this experiment was that warm water maximized the vocal range allowing the subjects to hit higher notes.

Help Received
Mother helped to proofread

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Kenneth Y. Lee

Project Number

S1207

Project Title

The Role of Testosterone in Hepatocyte Apoptosis in High Fat Diet-Induced Non-Alcoholic Fatty Liver Disease

Abstract

Objectives/Goals

The objective of this study was to learn whether hepatocyte apoptosis exists in the rat high fat diet (HFD)-induced non-alcoholic fatty liver disease model, and if so, whether or not testosterone reverses these apoptotic effects.

Methods/Materials

Adult male rats were randomly placed into four groups: castrated rats on HFD, castrated rats with Testosterone replacement on HFD, intact rats on HFD, and intact rats on regular chow diet (RCD). The rats were fed ad libitum for 15 weeks, sacrificed, and liver tissue was collected for detection of apoptosis. Terminal deoxynucleotidyl transferase dUTP nick end labeling (TUNEL) assay was performed to directly stain apoptotic cells brown. Western blot was used to evaluate concentrations of cleaved PARP (89 kDa), a common marker for cell apoptosis.

Results

Both the TUNEL assay and the Western blot showed that HFD notably increased hepatocyte apoptosis compared with RCD in intact rats. Furthermore, they also showed that testosterone replacement significantly reduced HFD-induced hepatocyte apoptosis in castrated rats. This provided evidence that testosterone did in fact reverse the apoptotic effects of NAFLD.

Conclusions/Discussion

It was ultimately concluded that testosterone treatment significantly reduces HFD-induced hepatocyte apoptosis in the rat liver. This study confirms the beneficial effect of testosterone on cell apoptosis associated with NAFLD, and may forge a path toward developing methods to eventually attenuate NAFLD in the future.

Summary Statement

This study is about the role of testosterone in reversing the apoptotic effects associated with NAFLD.

Help Received

Used lab equipment at Los Angeles Biomedical Research Institute under the supervision of Dr. Yue Jia.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Bonnie R. Lei

Project Number

S1208

Project Title

Incipient Speciation of the Mustached Bat Pteronotus parnellii in the West Indies

Abstract

Objectives/Goals

Populations of mustached bat Pteronotus parnellii on Hispaniola (H), Puerto Rico (PR), and geographic intermediate Isla Mona (IM) were studied through molecular, morphological, and echolocation analyses to determine the species' population structure in the West Indies.

Methods/Materials

DNA already extracted for specimens from 3 H, 2 IM, and 3 PR caves were PCR amplified for the mitochondrial cytochrome b gene. Amplicons were sequenced then aligned using Geneious Pro 4.8.3. Phylogenetic trees were constructed in PHYML and MrBayes 3.1.2. Fixed pairwise differences and migration rates among the islands were calculated using Arlequin 3.5.1.2 and Migrate-n 3.1.6, respectively.

Body, tail, ear, foot, and forearm length measurements for 78 total bats were analyzed through one-way analysis of variance (ANOVA) tests and unpaired t-tests implemented in R. Echolocation recordings for a total of 49 bats were analyzed for the constant frequency portion through ANOVA tests in R.

Results

Phylogenetic analyses of cytochrome b sequences indicate H and PR P. parnellii group in largely exclusive clades while IM bats are genetically similar to PR P. parnellii. Fixed pairwise differences indicate high and significant separation values between H and PR as well as between H and IM. There is no significant difference between PR and IM and migration occurs mainly from PR to IM, much less so from H to IM. All other inter-island gene flow was negligible.

Comparisons using ANOVA showed that H P. parnellii is significantly smaller and lighter, with smaller forearms and feet but longer tails than PR bats. IM bats are morphologically similar to either H or IM, depending on the measurement. H bats emit a significantly higher frequency than PR and IM in the constant frequency portion of their echolocation call, corroborating the genetic data.

Conclusions/Discussion

The results support classification of H P. parnellii population and the PR/IM population as separate species. Inter-island range expansion during the Wisconsinan glaciation followed by interglacial isolation is a possible incipient speciation mechanism. Determining this speciation event doubles the number of endemic species in Hispaniola, indicating the additional importance of conserving these species to maintain the full genetic diversity and population robustness of bats in the West Indies.

Summary Statement

A new bat species was discovered in the West Indies based on genetic, morphological, and echolocation analyses, thereby doubling the number of endemic species on Hispaniola.

Help Received

Used lab equipment at Stony Brook University under the mentorship of Dr. Liliana Davalos.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Kyle J. Lin

Project Number
S1209

Project Title
A Prospective Study on the Effect of Strength and Flexibility Conditioning on the Velocity of a Tennis Serve

Abstract

Objectives/Goals
The objective of my experiment was to determine if building rectus abdominis muscle strength or increasing wrist flexion over a period of 6 weeks improves tennis service velocity.

Methods/Materials
9 male test subjects were given questionnaires and informed consent forms. They were then randomized into 3 groups: trunk exercise, wrist exercise, and control. The subjects each served 5 serves at maximum velocity into the correct service box. Velocity, in miles per hour, was measured using a radar gun. During the experiment, the subjects in the trunk exercise group did 60 sit-ups each day. The maximum number of continuous sit-ups they were able to do was recorded. The subjects in the wrist exercise group did 3 minutes of wrist flexion extension stretching each day. Their maximum degree of wrist flexion was measured using a goniometer. After the initial baseline test, all measurements were repeated every 2 weeks for a time period of 6 weeks.

Results
The average service velocity of the trunk group increased from 91.1 mph to 91.7 mph (+0.8%). Their average maximum number of sit-ups changed from 104 to 131. The average service velocity for the wrist group increased from 86.3 mph to 88.4 mph (+2.5%). Their average wrist flexion improved from 60.7 degrees to 80.7 degrees. The average service velocity of the control group decreased from 84.9 mph to 81.7 mph (-3.8%).

Conclusions/Discussion
The results met the objective; they supported the hypothesis. Both experimental groups showed improvement in service velocity. Each group also demonstrated physical progress because of their respective conditioning regimens. The wrist exercise group showed a larger percentage of improvement in service velocity. Several uncontrolled variables that may have caused inaccurate results are temperature, fatigue, noncompliance in the exercise routines, and imprecise measurements.

Summary Statement
This experiment demonstrates the positive effects certain types of conditioning can have on the velocity of a tennis player#s serve.

Help Received
My mother assisted with scheduling dates for subject testing. Mrs. O'Donnell and my father guided data collection, organization, and analysis.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Crista Lee Havens; Darrel Manjarrez

Project Number

S1210

Project Title

Protein Concentration in Different Stages of Cow Lactation

Abstract

Objectives/Goals

The Imperial Valley is one of the top producers of many agricultural products and one of these products includes milk. Locally there are three dairies. The purpose of this experiment is to find out which stage of lactation in Jersey and Holstein cows produces a greater amount of total proteins in milk. The results of this investigation may be used to create a commercial combination of milk high in protein for human consumption. Total protein amount was chosen over the amount of the individual proteins because there is no commercial value attached to individual proteins.

We chose bullfrog farms under the supervision of Richard Vanleeuwen because they have two different breeds of cattle which we can compare (Jerseys and Holstein). Our hypothesis was that the earlier the stage of lactation, the higher the protein concentration because of the nutritional needs of the calf.

Methods/Materials

We extracted a total of 40 samples from different cows, 5 Holstein cows and 5 Jersey cows on each stage of lactation (colostrum, early, mid, and late) and performed protein analysis by spectrophotometry comparing the milk samples to a standard (bovine serum albumin). The independent variables for this experiment, manipulated independently from each other, are the lactation stage of the cow and the breed of the cow. The dependant variable for this experiment would be the consequential protein concentration of each sample from the different breeds and at different lactation stages.

Results

The results tend to show that there is a relationship between the stage of lactation of the cow and the protein content of the milk from the cow. In general, there is a decrease in concentration of protein in the later stages of lactation as opposed to the earlier stages. However, there seems to be an anomaly when it comes to the late lactation of Holstein cows. While there should be a decrease in concentration of protein and should even be the sample with the lowest concentration, the data shows that there is a sharp increase in the concentration in protein. Jersey cows produce milk with higher protein content in all four stages of lactation.

Conclusions/Discussion

The results gathered from these experiments tend to agree with our initial hypothesis, except for the final lactation state of Holstein cows. Reasons for this anomaly could be experimental error possibly when dealing with such minuscule amounts of sample in our procedure.

Summary Statement

The purpose of this experiment is to find out which stage of lactation in Jersey and Holstein cows produces a greater amount of total proteins in milk.

Help Received

Richard Vanleeuwen and Julio Alcantar from Bullfrog Farms.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Varun S. Sharma

Project Number
S1211

Project Title
The Effect of Exercise on Anxiety and the Possible Role of Basal Ganglia Function

Abstract

Objectives/Goals
Question: Does Exercise Effect Sensorimotor Gating and Anxiety?

Hypothesis: Exercise reduces anxiety and improves the ability to process information.

Methods/Materials
I placed 20 mice into individually housed cages with access to a spinning wheel. 10 mice were exercised and 10 mice were non-exercised. Wheels were locked for the non-exercised mice. After 2 weeks of the study, I conducted two tests to evaluate Anxiety and Sensorimotor Gating: Acoustic Startle Testing and Pre-Pulse Inhibition Startle Testing.

Results
1. Exercise reduced anxiety in the C57 black strain mouse population based on results from the Startle Testing data.

2. Exercise reduced anxiety in the C57 black strain mouse population based on results from the Pre-Pulse Inhibition Testing data.

Conclusions/Discussion
To quantitatively measure neurological benefits of exercise is difficult. In the exercise study I conducted this past summer, I found that the C57 Black Strain mice exhibited lower levels of anxiety based on results of the Pre-pulse Inhibition and Startle Testing. These results suggest that there are likely discrete effects of exercise that are transmitted to the brain that result in reduced anxiety. As the basal ganglia plays a critical role in the startle response these tests are an in-direct measure of basal ganglia function. Exercise is also known to stimulate muscle growth via a process called mitochondrial biogenesis. The results of the study suggest that exercise improves basal ganglia function possibly via increased mitochondrial biogenesis in the brain. Exercise may therefore play an important role in improving neurological function in a manner similar to improving muscle function.

Summary Statement
In the study conducted, I found that Exercise improved neurological activity, specifically Anxiety and Basal Ganglia function.

Help Received
Used lab equipment at University of California San Diego under the supervision of Dr. Victoria Risbrough. Also received advice and discussion to conduct exercise protocols in mice, training to conduct behavioral experiments and technical help for trouble-shooting problems.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Divya Siddarth

Project Number
S1212

Project Title
Fit and Fat: Fact or Fiction?

Abstract

Objectives/Goals
This project will determine if body mass index (BMI) is related to cardiovascular (CV) fitness in children and adolescents aged 12-18 years. I will also examine if the relationship between BMI and fitness changes depending on gender, ethnicity, socioeconomic status of the family, and age groupings.

Methods/Materials
I downloaded demographic, cardiovascular fitness and body mass index data of subjects aged 12-18 years from the National Health and Nutrition Examination Survey website. I classified subjects as normal weight, overweight or obese based on their BMI and as low fit, moderately fit or highly fit, based on their estimated oxygen uptake (VO2max). I computed frequency tables for BMI by CV fitness groups and calculated chi-square statistics using SAS to determine if these two variables were associated with each other. I also ran a regression model, with estimated VO2max as the dependent variable and BMI as the independent variable. I repeated these analyses for males and females, different ethnicities, income levels, and age groupings separately.

Results
The results show that only a small percentage of the children and adolescents aged 12-18 years were fit and fat. In addition, the linear regression demonstrated that BMI was inversely related to estimated VO2max. These findings were consistent within early (12-15 years) and late (16-18 years) adolescents, and within different ethnicities and income levels. However, more females compared to males were both fit and fat, and the relationship between BMI and VO2max was weaker in females than males, suggesting that the fit but fat theory is more likely to be valid in females than males.

Conclusions/Discussion
Obese and overweight children and adolescents had significantly lower cardiovascular fitness levels than did individuals with normal weight. Seventy percent of the obese children and nearly 50% of the overweight children were in the low fit category. However, over a tenth (12%) of the obese and overweight children were highly fit and another 30% of these children were moderately fit. This is encouraging, since it means that even obese and overweight children can achieve a degree of fitness that could potentially minimize their risk of heart disease and other weight-related illnesses.

Summary Statement
Obesity is associated with significantly reduced cardiovascular fitness in children and adolescents.

Help Received
Mother helped download data from NHANES website.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Sara K. Simpson

Project Number
S1213

Project Title
Testing a Nonlinear-Oscillator Neuron Model with Optical Illusions

Abstract

Objectives/Goals
A new physical framework of perception based on modeling neurons as nonlinear oscillators has recently been developed to explain the stroboscopic Wagon Wheel Illusion. This project tested the hypothesis that this model and framework could be extended to a second illusion, the Missing Fundamental Illusion, testing if the Missing Fundamental Illusion tends to support or contradict the theory that neurons are nonlinear oscillators.

Methods/Materials
Experiments involved both computer graphics presentations of four images (two based on the Wagon Wheel Image, and two based on the Missing Fundamental picture) as well as physical presentations using spinning wheels (optical choppers) and stroboscopic illumination (flashlight). The data from the latter presentation form was collected as the ratio of the stroboscopic period and the image repetition period was varied.

Results
The data from these experiments confirmed that, like the Wagon Wheel Illusion images, the Missing Fundamental images displayed the illusion over discrete ranges of the ratio of periods that fit the new framework of neurons as nonlinear oscillators. The Missing Fundamental Illusion itself was most clearly present at a small range surrounding and including the 1:4 and other even denominator ratios. However, the data at these ratios remained within the predicted zones of perception (locking zones), despite the presence of the Missing Fundamental Illusion.

Conclusions/Discussion
The strong agreement between the data and the predicted zones of perception shows again that the Wagon-Wheel Illusion supports the new model of perception, and also that the model can be extended to a second illusion with equal, if not stronger agreement with the data. It can therefore be concluded that the Missing Fundamental Illusion does support the theory that neurons are nonlinear oscillators, in agreement with the hypothesis. Insights about neuron behavior from this work may be applied in various fields of science.

Summary Statement
This project tests a model of perception, based on a theory that neurons in the brain function as nonlinear oscillators, with two optical illusions, and the experimental data indicates that both illusions support the theory and model.

Help Received
Sister helped with computer program, father supplied optical choppers and acted as 2nd observer

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Katherine Thomson; Rachel Thomson

Project Number

S1214

Project Title

Put One Foot in Front of the Other

Abstract

Objectives/Goals

Hypothesis: If a person's foot arches are higher and longer, then supination will be more likely to occur. If a person's foot arches are lower and shorter, then overpronation will be more likely to occur.

Methods/Materials

A left footprint was taken while sitting down, and another left foot print was taken standing, simulating a forward stride. The same process was repeated for the right foot. After this "Sit and Stand Test," subjects were filmed for 15-20 seconds while jogging on a treadmill at 5.5 mph. Measurements for arch length were taken from the heel to the ball of the foot on both types of footprints to calculate the average arch length. Balls of feet were marked on footprints. Footprints were examined to determine low, medium, or high arch height based on the surface area of the print. Video footage was viewed in slow motion so pronation status could be determined. Footprints were used to identify pronation status. Data were categorized by shoe size, arch length, arch height, and pronation status.

Results

After analysis of 74 films and 296 footprints (4 types of footprints per person), it was determined that there is a poor correlation between arch height, length and pronation status. However, the data depicts that there are relationships between the arch length and arch height, as well as the arch height and pronation. Commonly smaller feet that have shorter arches tend to have a medium to high arch height. Larger feet with longer foot arches exhibt a medium to low arch height, as opposed to a higher arch. Out of 74 subjects, 12 displayed low arches, 44 medium arches, and 18 high arches.

Pronation Status	Supination	Normal Pronation	Overpronation
Low Foot Arches	33% (4/12)	42% (5/12)	25% (3/12)
Medium Foot Arches	32% (14/44)	55% (24/44)	13% (6/44)
High Foot Arches	11% (2/18)	67% (12/18)	22% (4/18)
Overall Foot Arches	27% (20/74)	55% (41/74)	18% (13/74)

* ( ) = the number of people who performed at that Pronation Status over how many people displayed the certain foot arch height.

Conclusions/Discussion

Data does not support the hypothesis. There was no correlation between the foot arch length and height to pronation. Identifying one#s pronation status early in life can help to avoid health problems related to abnormal pronation in the future.

Summary Statement

The purpose of this project was to study and determine if there is a relationship between the length and height of foot arches and how one pronates.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Jasmine Tibayan; Edward Vasquez

Project Number

S1215

Project Title

The Throw-In Throw Off: A Study of the Correlation between Arm Length, Arm Circumference, and the Distance of a Throw-In

Abstract

Objectives/Goals

This project was designed to determine whether an increased arm length and/or circumference (i.e. the distance around the apex of the Biceps brachii and Triceps brachii muscles on the upper arm) provides a measurable distance advantage during a throw-in. We believe that a bigger, longer arm will throw farther than one much shorter and scrawnier.

Methods/Materials

Informed consent was obtained from 74 people, 37 high school males, one adult male, 34 high school females, and 2 adult females. Each participant's arm length, flexed arm circumference, and relaxed arm circumference were measured and recorded. Each participant then threw three times according to FIFA guidelines; after each throw, the distance was recorded.

Results

There was no substantial correlation between arm length and circumference vs. the distance of a throw-in.

Conclusions/Discussion

The data do not support the hypothesis. After analysis, there is no meaningful correlation between arm length and throw distance, or between arm circumference and throw distance. This lack of a relationship is probably due to variables that were neither controlled nor measured including: the small ranges in measured arm lengths and circumferences, body fat, and subject personal motivation. To a soccer player, this signifies that specifically training the arms will provide an advantage

Summary Statement

This project was designed to determine whether or not arm length or the circumference of the upper arm had any effect on the distance of an overhead throw-in in soccer.

Help Received

Parents helped with supplies/logistics; Mrs. Lewis and Mr. Grubb for assistance with analysis; Donald Mathis, for suggesting the measurement method; McKenzie Pantana, for assisting with data analysis

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Emily S. Wang

Project Number
S1216

Project Title
Observing to Understand the Foraging Skills of Captive Giant Pandas

Abstract

Objectives/Goals
In order to preserve and protect endangered giant pandas, I observed captive giant pandas at the Chengdu Base of Giant Panda Breeding and Research and looked at their foraging patterns to understand their current strengths and weaknesses. Ultimately, the big idea is to reintroduce the captive-bred giant panda with great survival skills back into the wild. I hypothesize that the pandas should be able to discover all the apples because all the apples were placed in close proximity.

Methods/Materials
Testing subjects included captive sub-adult giant pandas ages 3-5. In the mornings, before the pandas awakened to eat, I placed sliced apples in designated locations in the enclosure based on specific factors on the Observing Map. These factors included daily route, non-daily route, visibility, and scent. After placing the apples in the enclosure, I signaled the panda keeper to release the panda into the yard. I quietly observed their foraging actions and recorded the apples they ate on the Observing Table. Finally, I cleaned up the leftover apples after the panda returned to its indoor den.

Results
The two pandas I observed were SiYuan and JingJing. in the summer, SiYuan was able to discover 22/24 apple slices, while JingJIng was able to find 16/24. During the winter, SiYuan discovered 13/32 apple slices, while JingJIng found 16/32. SiYuan and JingJing both found their first apple within the first 2 minutes. The eaten apples were mostly located on the daily route. The apples that were not found were the ones on: high walls, tree stumps, deep grass, ditches, rocks, and behind structures.

Conclusions/Discussion
I found that captive giant pandas prefer finding food sources that are within their daily travel patterns, which is hazardous. As pandas live in areas of abundant food, they may be able to stay in this area to save energy and avoid traveling too far. However, if their local food source is depleted, the pandas will be forced to search far, which may be difficult because they are so accustomed to foraging in once food-flourishing areas. Moreover, the panda's olfactory is useful in searching for strong scented foods. Captive pandas are not afraid of tourists passing by their enclosure, which shows their lack of regard for humans as a potential enemy. It is important that our captive giant pandas do not develop reliances on humans.

Summary Statement
I observed captive giant pandas' foraging behaviors and provided scientific data and analysis to prepare the giant pandas for reintroduction into the wild.

Help Received
Dr. Sarah Bexell provided valuable feedback on preliminary design proposals and approved of final project, Experiment conducted under supervision of Mr. Xiang Bo