Introduction

The purpose of this section is to provide lecturers and teachers with some ideas for experiments that can be used to illustrate issues raised in each of the chapters. It will also help students to understand research findings and to write a research report. I am aware that everyone does not have the same facilities, which will vary from not having any specialist equipment at all to well-equipped laboratories. Therefore, in most experiments, I have provided optional Methods, one for those who have no specialist equipment and one for those with some specialist equipment. I am also well aware that policies regarding the teaching of statistics vary between institutions, as does the availability of statistical packages for student use. Therefore, where necessary, I have included alternative ways of calculating inferential statistics. If class sizes are small, I suggest that you use 10% probability ($p = 0.10$) rather than 5% ($p = 0.05$) for significance. Otherwise you get Type II errors and students find themselves having to argue that something is non-significant when, in fact, it is significant.

For lecturers and teachers

How you choose to use this is, of course, up to you. It can be used as a laboratory manual or in class. You can also, obviously, make alterations to the designs and protocols. Students can be required to write up each experiment or specific experiments or the results can be used as the basis for seminars.
For students

As well as carrying out the experiments, you can use them to help you design your own experiments for projects. At the end of each experiment, I have provided you with some suggested readings. These are to help you make sense of the experiments and to use in the Discussion section when writing up a research report. However, you need to undertake additional reading. To do this you need to use search engines like Sports Discus, PubMed, Web of Knowledge, Bing, Google and Google Scholar. When reading research reports you will implicitly learn how to write a report. Each journal has its own style of writing and your university may well have its own style. However, the norm is to have Introduction, Method, Results and Discussion sections. In the Introduction, you set out the problem, stating the research question, and any hypotheses. In the Method, one normally follows a description of participants followed by a description of tests and finally the procedure. You will see that I have included sub-sections called ‘apparatus’ and ‘organization’, these are for the use of your lecturers and are not normally included in a Method section, although some journals have a sub-section called ‘materials’. One also often sees a subsection called ‘statistical analysis’. I have included this in the results section. In the Results section, simply state the results, do not comment on them. In the Discussion, show how the findings relate to past research and theory discussed. If the study is an applied study, state what the implications are for practical situations.
Experiment 1: Are Abilities Specific?

Introduction

Abilities refer to basic innate actions that underlie skillful performance. Henry (1968) found no significant correlations between abilities and, therefore, claimed that they were specific and unique. Fleishman (1954), however, argued that there were small to moderate, significant correlations between abilities that possessed similar factors. Therefore, the purpose of this study is to examine whether or not there are correlations between chosen abilities. If all of the abilities correlate significantly, this would support general ability theory. If the balance abilities correlate significantly and the reaction time abilities do likewise, we can say that the results support Fleishman. However, if there are no significant correlations, Henry’s specificity hypothesis is supported.

Method A

Apparatus

Gymnastics bench, stopwatch, 30 cm (12 inch) ruler (or similar) and blindfold.

Tests

Static balance

Wearing the blindfold, the participant stands on their non-dominant leg for as long as possible (set a time limit of 60 s). The experimenter takes the time. Have three trials. The dependent variable is the mean time.
**Ballistic balance**

Turn the gymnastics bench upside down. Walk across the bar at the bottom as quickly as possible. Have safety mats at either side of the bar in case the person falls. The experimenter times the walk. Have three trials. The dependent variable is the mean time.

**Visual reaction time**

The participant places their thumb and index finger either side of the ruler, at the zero mark. The experimenter says ‘ready’ before they let the ruler fall. Vary the time of the foreperiods (time between saying ‘ready’ to actually dropping the ruler). The participant tries to catch the ruler, between their finger and thumb, as fast as possible. The distance from zero that the participant catches the ruler measures the reaction. Have 20 trials. The dependent variable is the mean distance.

**Auditory reaction time**

The same as for visual reaction time except that the participant wears the blindfold and the experimenter says ‘now’ as they let go of the ruler. Have 20 trials. The dependent variable is the mean distance.

**Method B**

**Apparatus**

Gymnastics bench, stabilometer, stopwatch, reaction timer.

**Tests**

**Ballistic balance**

Turn the gymnastics bench upside down. Walk across the bar at the bottom as quickly as possible. Have safety mats at either side of the bar in case the person falls. The experimenter times the walk. Have three trials. The dependent variable is the mean time.

**Dynamic balance**

Participants try to balance on the stabilometer for 60s. Experimenters set the ‘in balance’ range as being 15°. Have three trials. The dependent variable is the mean time.

**Visual reaction time**

Use one light and one response button. The participant presses the button as soon as possible following illumination. The experimenter says ‘ready’ before they illuminate the light (in most choice reaction timers there is a warning light included but this needs to be set). Vary the time of the foreperiods (time between saying ‘ready’ and illuminating the light). Have 20 trials. The dependent variable is the mean time.
Auditory reaction time

The same as for visual reaction time except that the experimenter activates the buzzer rather than the light. The participant presses the button as soon as possible following the sound of the buzzer. Have 20 trials. The dependent variable is the mean time.

Procedure

Each participant undertakes each of the tests.

Results

Fill in the master sheet (see Appendix 1A). Using all of the data for the class or group carryout a series of Pearson correlations between the different dependent variables.

Discussion

Did the balance abilities correlate significantly?
Did the reaction time abilities correlate significantly?
Were there any correlations between balance and reaction time abilities?
What do these results say about Fleishman’s theory, Henry’s theory and general motor ability theory?
How do these results fit in with past research and theory?

References


Suggested readings

The above plus
## Example of individual score sheet

<table>
<thead>
<tr>
<th>Trial</th>
<th>Static balance</th>
<th>Dynamic balance</th>
<th>Visual reaction time</th>
<th>Auditory reaction time</th>
</tr>
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<tbody>
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<td></td>
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<td>5</td>
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<td></td>
</tr>
<tr>
<td>Mean</td>
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</tr>
</tbody>
</table>

## Master sheet

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<th>Static balance</th>
<th>Dynamic balance</th>
<th>Visual reaction time</th>
<th>Auditory reaction time</th>
</tr>
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</tr>
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<td></td>
</tr>
<tr>
<td>SD</td>
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</tr>
</tbody>
</table>
Experiment 2: Expertise and Selective Attention

Introduction

Selective attention refers to the skill of focusing attention onto task relevant cues at the expense of irrelevant ones. It is thought that we need to use selective attention because we have a limited amount of channel space in which to process information (Welford, 1968). Expert performers can ignore irrelevant information and respond only to relevant cues. Therefore, in this experiment, we compare the performance of individuals, who participate in ball games and those involved in non-ball games sports such as track and field, swimming, gymnastics and so on, on a selective attention task. We hypothesize that the ball games players will perform significantly better than the non-ball games players.

Method A

Apparatus

Table tennis balls (these should include some coloured balls – wipe board markers can be used to colour the balls), a cylindrical piece of cardboard (~20 cm long), called the cardboard shoot.

Participants

Divide the class into those who play ball games, expert groups, and those who do not, novices group.
Procedure

The experimenter places 30 balls (20 white and 10 coloured) in a box, hidden from the participant’s view. The top of the cardboard shoot is hidden from the participant’s view (use a cloth if necessary). The participant places their preferred hand on a table, ~1.5 m below the bottom of the shoot and 10 cm to the side. The experimenter gives a warning signal by saying ‘ready’ before letting one of the balls drop through the shoot (vary the length of this foreperiod). The participant is instructed to try to catch the white balls but leave the coloured balls alone and not move his/her hand from the table. The experimenter randomly chooses a ball and continues until the box is empty. For white balls, 2 points are given for a successful catch, and one if the hand makes contact with the ball but it is dropped. For the coloured balls, 2 points are given if the hand remains on the table, –1 if the hand comes off the table and –2 if the ball is caught. The total score is the dependent variable.

Method B

Apparatus

Table tennis balls or tennis balls (these should include some coloured balls – wipe board markers can be used to colour table tennis balls), table tennis ball firer or tennis ball firer.

Participants

Divide the class into those who play ball games, expert groups, and those who do not, novices group.

Procedure

The experimenter places 30 balls (20 white and 10 coloured) in a box, hidden from the participant’s view. The top of the ball firer is hidden from the participant’s view (use a cloth if necessary). Based on the speed at which the the ball firer is set; the participant sits at a distance which allows her/him to comfortably catch the ball. The participant places their preferred hand on a table, ~10 cm to the side of them. The experimenter gives a warning signal by saying ‘ready’ before placing one of the balls into the ball firer (vary the length of this foreperiod). The participant is instructed to try to catch the white balls but leave the coloured balls alone and not move his/her hand from the table. The experimenter randomly chooses a ball and continues until the box is empty. For white balls, 2 points are given for a successful catch, one if the hand makes contact with the ball but it is dropped. For the coloured balls, 2 points are given if the hand remains on the table, –1 if the hand comes off the table and –2 if the ball is caught. The total score is the dependent variable.

Results

Scores for the expert group and novice group are compared using a one-tailed, independent samples t-test. It is one-tailed because we are testing a directional hypothesis, i.e. we have hypothesized that the experts will do better than the novices. It is independent because there are different individuals in each group and they are not matched in anyway.
Discussion

Did the experts do significantly better than the novices?
Was there a large difference between groups?
Do you think that past experiences of the novice group might have affected these results?
Might you get different results if your novice group were made up of sedentary, non-athletic individuals?
How do these results fit in with past research and theory?

Reference


Suggested readings

The above plus
Experiment 3: Expertise and Decision Making

Introduction

Decision making is ‘knowing which technique to use in any given situation’ (Knapp, 1963, p. 3). Previous research has shown experts to be better than novices (McMorris & Beazeley, 1997; Vaeyens et al., 2007) and it is generally thought that decision making improves with experience. Therefore, in this study, we examined the decision-making performance of experts and novices in a _____________ (add your chosen activity) sports-specific task.

Method A

Apparatus

Choose a game of which sufficient class members will have some experience so that an expert group can be formed. Devise a decision-making test using a multi-choice format (follow the example from McMorris et al., 2006, in Appendix 3A). Make between 10 and 15 trials.

Participants

Divide the class into those with experience of the task, expert group, and those with limited or no experience, novice group.

Procedure

The experimenter gives the class the trials face down on their desk. The experimenter tells the class to turn over the first trial. They have a separate answer sheet numbered 1–15. On the answer sheet they mark a, b, c or d dependent on which they think is the
correct action for the player in possession of the ball (or puck in ice hockey). The experimenter tells the class to stop answering that question after 5 s and to turn to the next trial. The dependent variable is the number of correct answers.

Method B

Apparatus

A slide projector fitted with a tachistoscopic timing device. Choose a game of which sufficient class members will have some experience so that an expert group can be formed. Devise a decision-making test using a multi-choice format (follow the example from McMorris et al., 2006, in Appendix 3A, below). Make between 10 and 15 trials. Copy these onto slides.

Participants

Divide the class into those with experience of the game, expert group, and those with limited or no experience, novice groups.

Procedure

The experimenter presents each slide for 5 s using the slide projector. Participants have an answer sheet numbered 1–15. On the answer sheet they mark a, b, c or d dependent on which they think is the correct action for the player in possession of the ball (or puck in ice hockey). The dependent variable is the number of correct answers.

Results

Performance of the two groups is compared using a one-tailed, independent samples t-test.

Discussion

Were the expert better than the novices?
Was there any effect of novices taking part in games which involve similar decisions?
How do these results fit in with past research and theory?
How realistic is this test?
Could you use this test as a way of learning decision making?

References


**Suggested readings**

The above plus

Appendix 3A

Example of a soccer decision-making test.
Experiment 4: Probability and Choice Reaction Time

Introduction

Alain and Proteau (1980) and Dillon et al. (1989) found that reaction time to a stimulus that has a 50% chance of being presented is significantly slower to that when there is a 90% or 80% chance of the stimulus being presented. In this experiment, we test these claims. We hypothesize that mean times for the 50% conditions will be significantly slower than for the 90% and 80% conditions.

Method A

Apparatus

Two 30 cm (12 inch) rulers or similar.

Procedure

The participant places the thumb and index finger, of their preferred hand, either side of one of the rulers, at the zero mark. They place the thumb and index finger of their non-preferred hand either side of the other ruler, also at the zero mark. The participant is told that they have to catch whichever ruler is let fall, as quickly as possible. In one condition they are told that each ruler will be dropped 50% of the time. In another condition they are told that the ruler on the side of their preferred hand will be dropped 90% of the time and the other ruler 10%. In the third condition, they are told that the ruler on the side of their preferred hand will be dropped 80% of the time and the other ruler 20% (the experimenter will need a sheet of paper with the order of presentation written on it). Before letting the ruler drop, the experimenter says ‘ready’. Vary the time of the foreperiods (time between saying ‘ready’ to actually dropping the ruler).
The distance from zero that the participant catches the ruler measures the reaction. Have 40 trials in each condition. Only measure performance by the preferred hand. The dependent variable is the mean distance. Vary the order in which the participants carry out each of the conditions, in order to limit learning effects. Allow 10 practice trials before starting.

**Method B**

**Apparatus**

Choice reaction timer

**Procedure**

The participant places the index finger, of their preferred hand, on one of the response buttons. They place the index finger of their non-preferred hand on another response button. The participant is told that they have to press the button corresponding to whichever light is illuminated, as quickly as possible. In one condition they are told that each light will be illuminated 50% of the time. In another condition they are told that the light above their preferred hand will be illuminated 90% of the time and the other light 10%. In the third condition, they are told that the light above their preferred hand will be illuminated 80% of the time and the other light 20% (the experimenter will need a sheet of paper with the order of presentation written on it). Before illuminating the light, the experimenter says ‘ready’ (in most choice reaction timers there is a warning light included but this needs to be set). Vary the time of the foreperiods. Have 40 trials in each condition. Only record reaction time by the preferred hand. The dependent variable is the mean time. Vary the order in which the participants carry out each of the conditions, in order to limit learning effects. Allow 10 practice trials before starting.

**Results**

Calculate each participant’s mean times (or distances) for each condition. Put these on a Master sheet and carry out one of the following tests. The correct test is a one-way repeated measures analysis of variance (RM ANOVA). It is repeated measures because everyone has carried out all of the tests. RM ANOVA can be found in most statistics packages and also on some scientific calculators. If the RM ANOVA shows a significant result \( p < 0.05 \) then you can carry out post hoc tests. A significant RM ANOVA tells you that there is a difference caused by the treatment but it does not tell you whether it is between 50% and 90% or 50% and 80%, or between 90% and 80%. Therefore, we need to carry out the post hoc tests. As our hypothesis states that the 50% condition will be slower than the other two conditions, we are not interested in comparing the 80% and 90% conditions. Therefore, we need only to carry out paired t-tests between the 50% and 90% conditions, and 50% and 80% conditions. However, because we are carrying out multiple t-tests we need to add the Bonferroni correction factor. This means that, for a difference to be significant, it needs to show a probability of \( p < 0.025 \). If you cannot carry out a RM ANOVA, simply do the t-tests with Bonferroni corrections. However, note that one really should not do this unless the RM ANOVA has been tested and is significant.
Discussion

Was the mean reaction time for the 50% condition significantly slower than for the 90% and 80% conditions?
Which theories provide explanations for such results?
Having completed the task yourself, which of the theories do you think provides the better rationale?
Do you think that there might be other explanations for these findings rather than those put forward by Alain and Proteau (1980) and Dillon et al. (1989)?
How do these results fit in with past research?

References


Suggested readings

The above plus
Introduction

The purpose of this study was to examine whether we can implicitly or sub-consciously learn to anticipate an event. This experiment could also be used with regard to Chapter 8, Learning I: types, theories, styles and measurement.

Method A

Apparatus

Two 30 cm (12 inch) rulers or similar.

Organization

The students need to be divided into threes, one experimenter and two participants, numbered one and two. It is important that the participants do not know what the design of the experiment is before taking part.

Procedure

The participant places the thumb and index finger, of their preferred hand, either side of one of the rulers, at the zero mark. They place the thumb and index finger of their non-preferred hand either side of the other ruler, also at the zero mark. The participant is told that they have to catch whichever ruler is let fall, as quickly as possible. They are given a pre-test of 20 trials. The experimenter follows a set pattern (this needs to be provided for the experimenter and should be in the sequence of Left, Left, Right, Right
repeated) of release of the rulers. Vary the time of the foreperiods (time between saying ‘ready’ and actually dropping the ruler). The distance from zero that the participant catches the ruler measures the reaction. Following this, number one participants undertake the task with random selection of which ruler is let fall. Number two students follow the set pattern, used in the pre-test, repeatedly. They have 100 trials in blocks of 20, with the experimenter alternating between that two participants. Participants then repeat the pre-test using the same set pattern. The dependent variable is the mean distance.

**Method B**

**Apparatus**

Four choice reaction timer.

**Organization**

The students need to be divided into threes, one experimenter and two participants, numbered one and two. **It is important that the participants do not know what the design of the experiment is before taking part.**

**Procedure**

The participant places the first two fingers of each hand on one of the response buttons. The participant is told that they have to press the button below whichever light is illuminated as quickly possible. They are given a pre-test of 20 trials. The experimenter follows a set pattern (this needs to be provided for the experimenter and should be in sequence, e.g., Far Left, Second Right, Far Right, Second Left, repeated) of illumination of the lights. Vary the time of the foreperiods. Following this, number one students undertake the task with random selection of which light is illuminated. Number two students follow the set pattern, used in the pre-test, repeatedly. They have 100 trials in blocks of 20, with the experimenter alternating between that two students. Participants then repeat the initial test using the same set pattern. The dependent variable is the mean time.

**Results**

Calculate the mean times for each participant on the pre-test and post-test. Calculate the difference from pre- to post-test for each participant separately. This is called the delta (Δ) score and can be negative or positive. Remember that a negative score mans that they got faster. Enter the Δ score onto a Master sheet and carry our an independent t-test between the two groups, the number one and number two participants. The number ones should be classed as the control group and the number twos as the experimental group.

**Alternative statistics**

A 2-way (group×time) analysis of variance (ANOVA) with repeated measures on pre- to post-test could be carried out. This will allow for examination of the pre- to post-test within group results, i.e., did either group improve significantly from pre- to post-test. To use 2-way ANOVA, mean times for each person in each test will need to be entered
into the analysis rather than $\Delta$ scores. However, if there are significant pre-test between group differences, the $\Delta$ method will need to be used.

**Discussion**

Were the $\Delta$ scores for the experimental group significantly better than for the control group?
Did the experimental group show an improvement from pre- to post-test?
Were any of the participants aware during practice that they were following a set order?
Do you think that perceptual anticipation is learned subconsciously in sport?
How do these results fit in with past research and theory?

**Suggested readings**

Experiment 6: Peripheral Vision and Motor Control

Introduction

Vision is the most important of the senses and plays a major role in motor control. The central portion of the eye, the fovea, is rich in nerve receptors, which allows it to extract detail from an object. As such its main role is to identify objects, although it does play a part in motor control. The range of foveal or central vision is generally regarded as being between 2° and 5°. The vision outside of this range is referred to as peripheral vision. The receptors, here, are less dense and images are less distinct than those found in foveal vision. Peripheral vision provides us with information about our position with reference to the floor, the roof or sky, walls or trees and buildings and also the position of our limbs. While carryout a motor act, such as shooting at basket in basketball, knowledge of where our arms are will aid performance. Therefore, in this experiment, we compare shooting at basket with full vision to that when peripheral vision is blocked.

Method

Apparatus

Basketball hoop and backboard, basketball, swimming goggles. Black out the swimming goggles with the exception of a 0.5 to 1 cm diameter circle in the middle of the goggles.

Test

Participants shoot 40 balls at the hoop, 20 with normal vision and 20 wearing the goggles. Counterbalance the order of the conditions. Three points are given for a swish, two if the ball hits the rim or backboard before going through the hoop, one if it hits the rim and does not go through the hoop. The dependent variables is the total number of points.
**Results**

Scores on the full vision and foveal vision only (wearing the goggles) conditions are compared by a paired t-test.

**Discussion**

Was the full vision score significantly better than the foveal only?
What was the problem when shooting without peripheral vision?
Did anyone try to use a strategy to overcome the problem? If so, how successful was it?
How do these results fit in with past research and theory?

**Suggested readings**


Experiment 7: Short-term Motor Memory: Are Locations Better Remembered than Distances?

Introduction

It is generally thought that, in short-term motor memory (STMM) situations, locations are retained better than distances. Therefore, in this experiment we compare STMM for distance with that for location.

Method

Apparatus

Pencil, paper (A3), ruler and blindfold. If you have access to commercially bought curtain rail type apparatus that is easier to use.

Procedure

Draw a line from the top of the A3 paper to the bottom (it is best to have a wide line ~5 cm), then turn the paper on its side. Blindfold the participant. Place the index finger of the participant’s preferred hand somewhere along the line. In condition one, guide the participant’s finger along the line to a point of your choosing (mark this point in pencil). Place the participant’s finger on the line but at a different starting point. Tell them to move along the line to the location at which you finished. Measure the distance from where the participant stops and the actual location. Repeat this 10 times. In condition two, move the participant’s finger along the line to a chosen point and measure the
actual distance moved. Then place their finger at a different starting point and ask them to move the same distance. Measure this and calculate the difference between it and the actual distance moved originally. Repeat 10 times. Ignore plus and minus signs, and calculate the mean error for each condition for your participant. Place this on a Master sheet and calculate the group means for locational and distance errors.

**Results**

Compare class scores using a paired samples $t$-test.

**Discussion**

Were locations remembered better than distances?
Did any participants use strategies such as counting during the guided movement?
Did any participants use mental rehearsal?
How do these results fit in with past research and theory?
How relevant do you think this experiment is to memorizing sports skills?

**Suggested readings**

Experiment 8: Performance Curves: Effect of Task Difficulty

Introduction

Learning is often measured using performance curves. Performance of the learner is plotted over a number of trials and is shown graphically but the curve is smoothed out. There are four common types of curve that have been found by researchers, negatively accelerated curves, there is an early improvement but then performance tapers off somewhat; positively accelerated curves, there is an overall general improvement which is slow at first and then accelerates; linear improvement; and ogive or S-shaped curves. The actual nature of the curves is thought to depend on task difficulty but is also affected by individual differences in abilities and experience. In this experiment, we compare the learning of a comparatively simple skill and a more difficult one. This is a case study because we only examine the performance of one participant.

Method

Organization

Divide the class into twos. Designate one person to be the experimenter and one the participant. In this example, I am using two soccer tasks, one simple and one difficult. You can choose two very different tasks from any activity but be sure that you have some way of measuring performance.

Procedure

The simple task is a soccer passing task. The participant stands 7.6 m from a target (30 cm wide), marked on a gymnastics bench. The participant has to kick the ball at the target. They score five if they hit the target and 4, 3 or 2 for the areas either side of the target.
(see Appendix 8A). They have 40 trials. Plot a graph of performance. The difficult task is to juggle the ball in the air, not allowing it to fall to the ground. Count how many touches the participant has before the ball hits the ground. They have 40 trials. Plot a graph of performance. If you have good soccer players make them carryout the task using their non-preferred foot only.

**Results**

Plot the graphs and smooth out the curves.

**Discussion**

What kind of graphs did you get?
Were they as expected?
Why do you think they show these kinds of curves?
How do they compare to other people in the class?
How did individual differences (e.g. past experience) affect the curves?
How do these results fit in with past research and theory?

**Suggested reading**

I was not able to find any suitable readings for this topic.
Introduction

Focus of attention, during practice, can be external or internal. An external focus is one which is involved with outcome, while an internal focus is concerned with the process of performing. Wulf et al. (2001) claimed that an external focus allows automatic, implicit control of movement, while an internal focus induces non-automatic, conscious control. Research comparing external and internal foci have tended to show that the former is more advantageous (e.g., Shafizadeh et al., 2011). However, some have argued that an external focus is advantageous to experts, while beginners do better with an internal focus (e.g., Perkins-Ceccato et al., 2003). In this experiment, we compare the effects of an external focus, focusing on the basketball hoop, with an internal focus, concentrating on the movement of the arm, while practising a basketball set-shot using the non-preferred hand.

Method

Organization

Divide the class into two groups, an external focus group and an internal focus group.

Procedure

Both groups are tested performing a basketball set-shot, with their non-preferred hand, in a pre-test (20 trials). Three points are given for a swish, two if the ball hits the rim or backboard before going through the hoop, one if the ball hits the rim but fails to go through the hoop. The final score is the total number of points. Following this, the
external focus group are told to focus on the hoop while practising. The internal group are told to focus on the feel of their arm movement. Both groups have 40 practice trials, before undertaking a post-test (20 trials). Following a non-practice period (this can be as short as 10 mins or as long as one week), the groups undertake a retention test (20 trials).

**Results**

Calculate the $\Delta$ score from pre-test to post-test and from pre-test to retention test. Using an independent samples t-test compare the $\Delta$ score for the groups from pre- to post-test and from pre- to retention test.

**Discussion**

Did the groups differ in their pre- to post-test scores? If so, what is the relevance of this?
Did the groups differ in their pre- to retention test scores? If so, what is the relevance of this?
Did basketball players in the class show different results to non-basketball players [if there are sufficient basketball players in the class ($\geq$10), their scores could be compared to the rest of the group using an independent samples t-test]?
How do these results fit in with past research and theory?

**References**

Experiment 10: Moderate Intensity Exercise and Performance of a Central Executive Task

Introduction

Moderate intensity exercise has been shown to facilitate performance of central executive tasks, particularly those requiring inhibition of prepotent responses (McMorris and Hale, 2012). In this experiment, we compare the effect of 15 min exercise at 75% maximum heart rate ($HR_{\text{MAX}}$) on the performance of an inhibition task.

Method A

Apparatus

Table tennis balls (these should include some coloured balls – wipe board markers can be used to colour the balls), a cylindrical piece of cardboard (~20 cm long), called the cardboard shoot.

Participants

Divide the class into two groups, the exercise group and the non-exercise group.

Task

The experimenter places 30 balls (20 white and 10 coloured) in a box, hidden from the participant’s view. The top of the cardboard shoot is hidden from the participant’s view (use a cloth if necessary). The participant places their preferred hand on a table, ~1.5 m below the bottom of the shoot and 10 cms to the side. The experimenter gives a warning signal by saying ‘ready’ before letting one of the balls drop through the shoot (vary the
length of this foreperiod). The participant is instructed to try to catch the white balls but leave the coloured balls alone and not move his/her hand from the table. The experimenter randomly chooses a ball and continues until the box is empty. For white balls, 2 points are given for a successful catch, and one if the hand makes contact with the ball but it is dropped. For the coloured balls, 2 points are given if the hand remains on the table, –1 if the hand comes off the table and –2 if the ball is caught. The total score is the dependent variable.

**Procedure**

For the exercise group, calculate $75\% \text{ HR}_\text{MAX}$ using the formula $75/100 \times 220$-age. Following a 5 mins warm-up at a very low resistance, have the group exercise at $75\% \text{ HR}_\text{MAX}$ for 15 mins on a cycle ergometer. Allow the participant to pedal at their own rate but alter the resistance accordingly to maintain $75\% \text{ HR}_\text{MAX}$. Immediately following cessation of the exercise have the person undertake the test. The members of the non-exercise group sit for 15 mins before taking the test.

**Method B**

**Apparatus**

Table tennis balls or tennis balls (these should include some coloured balls – wipe board markers can be used to colour table tennis balls), table tennis ball firer or tennis ball firer.

**Participants**

Divide the class into two groups, the exercise group and the non-exercise group.

**Task**

The experimenter places 30 balls (20 white and 10 coloured) in a box, hidden from the participant’s view. The top of the ball firer is hidden from the participant’s view (use a cloth if necessary). Based on the speed at which the the ball firer is set; the participant sits at a distance which allows her/him to comfortably catch the ball. The participant places their preferred hand on a table, ~10 cm to the side of them. The experimenter gives a warning signal by saying ‘ready’ before placing one of the balls into the ball firer (vary the length of this foreperiod). The participant is instructed to try to catch the white balls but leave the coloured balls alone and not move his/her hand from the table. The experimenter randomly chooses a ball and continues until the box is empty. For white balls, 2 points are given for a successful catch, one if the hand makes contact with the ball but it is dropped. For the coloured balls, 2 points are given if the hand remains on the table, –1 if the hand comes off the table and –2 if the ball is caught. The total score is the dependent variable.

**Procedure**

For the exercise group, calculate $75\% \text{ HR}_\text{MAX}$ using the formula $75/100 \times 220$-age. Following a 5 mins warm-up at a very low resistance, have the group exercise at $75\% \text{ HR}_\text{MAX}$ for 15 mins on a cycle ergometer. Allow the participant to pedal at their own rate
but alter the resistance accordingly to maintain 75% \( HR_{\text{MAX}} \). Immediately following cessation of the exercise have the person undertake the test. The members of the non-exercise group sit for 15 mins before taking the test.

**Method C**

**Participants**

Divide the class into two groups, the exercise group and the non-exercise group.

**Task**

Eriksen’s flanker task (Eriksen and Eriksen, 1974).

**Procedure**

For the exercise group, calculate 75% \( HR_{\text{MAX}} \) using the formula \( \frac{75}{100} \times 220 \)-age. Following a 5 min warm-up at a very low resistance, have the group exercise at 75% \( HR_{\text{MAX}} \) for 15 min on a cycle ergometer. Allow the participant to pedal at their own rate but alter the resistance accordingly to maintain 75% \( HR_{\text{MAX}} \). Immediately following cessation of the exercise have the person undertake the test. The members of the non-exercise group sit for 15 min before taking the test.

**Results**

For methods A and B compare scores using an independent samples \( t \)-test. Using the flanker task, you can compare times between groups for congruent and incongruent trials separately, using independent samples \( t \)-tests, or you can use a group \( \times \) congruency analysis of variance, with post hoc \( t \)-tests using the Bonferroni correction factor.

**Discussion**

Did the exercise group do better than the non-exercise group?

If you used the flanker task, were the exercise group better on the incongruent trials only?

How do these results fit in with past research and theory?

Might results have been different if both groups had have carried out both the pre-and post-tests?

Is \( 220 - \text{age} \) a valid measure of \( HR_{\text{MAX}} \)?

**References**


Suggested readings

