MCAT Psychology and Sociology 1 Homework

Passage I (Questions 1-5)

This passage introduces the topic of athletic skill and discusses the factors that influence it. The first paragraph tells us that athletic skill is influenced chiefly by genetic factors and by environmental factors. Studying twins gives scientists good insight on how each of these play a role.

The second paragraph discusses a specific twin study. Athletic skill (measured in three different arenas) was measured in identical twins, separated identical twins, and fraternal twins. The general population was used as a control. The scientists found that the more unrelated the subjects, the more they differed in athletic skill.

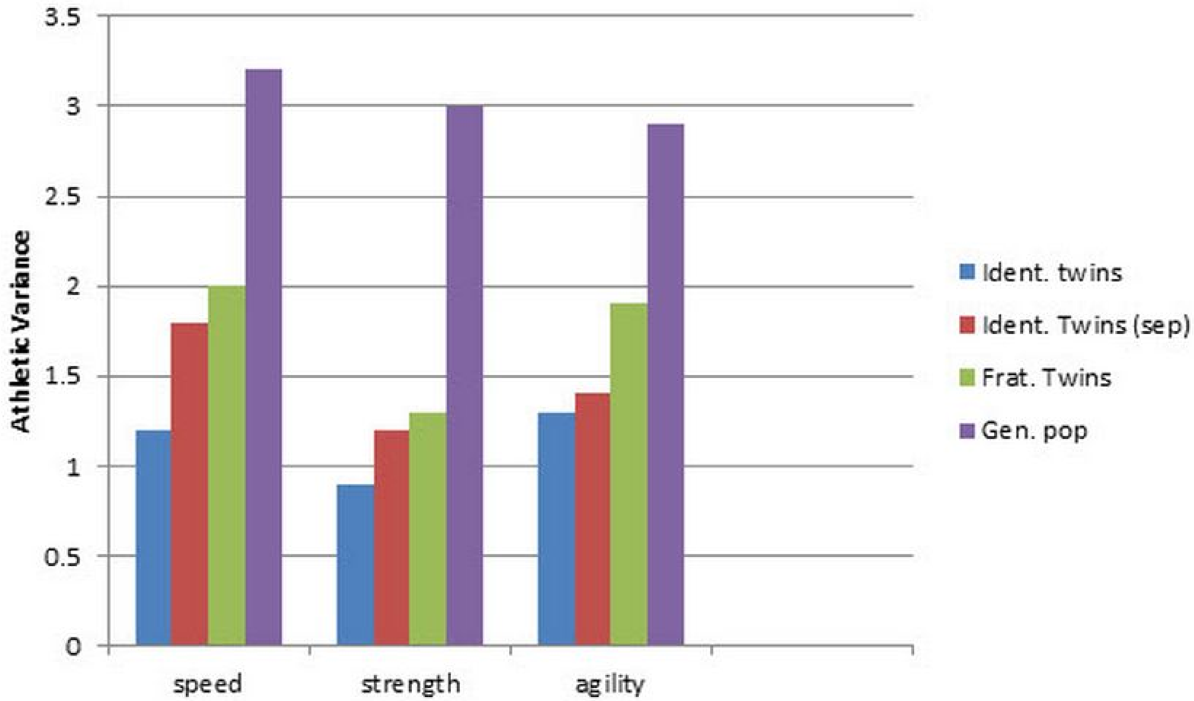
Passage Outline

Paragraph 1: Athletic skill-nature vs. nurture. Twin studies useful

Paragraph 2: Twin study-athletic skill in ident. twins vs. sep. ident. twins vs frat. twins vs.control ↑relatedness=↓athletic variance, p=.07

Question 1: C

The first question asks us to choose the best visual representation for the study described. Here we can make a decent prediction. What were were measuring in our experiment? Athletic variance between three different groups of twins and the general population. We have four different groups that we are measuring. When we have multiple groups of related data, bar graphs are an appropriate choice. A bar graph for this experiment might look like this:



Answer (A): Pie charts are appropriate when we are depicting parts of a whole. Separating whole populations or communities into distinct groups would call for a pie chart i.e. ethnic groups in a community. Answer (B): Scatter plots are good for when we have 1) numerical data and 2) the data is paired. We need two numerical variables that correspond to each other. For example, if we were measuring the number of gene mutations vs. carcinogen levels. Both are quantifiable and we can take a sample (i.e. tissue) and measure the carcinogen level and number of mutations for that sample. Answer (C): Bar graphs are great for multiple sets of data. Answer (D): Similar to the scatter plot, line graphs are appropriate when we have two quantifiable variables. Line graphs are especially useful when the independent variable (x axis) is time.

Question 2: D

This question gives us four graphs and asks us which one represents the relationship between genetic and athletic variance in the general population. We know from the passage that there is a negative (inverse) relationship between genetic relatedness and athletic skill. This can be represented as: ↑relatedness=↓athletic variance Another way to write this same relationship is: ↑genetic variance=↑athletic variance This way of expressing the relationship is useful here because it puts it in the terms used in the answer choices.

Answer (A) shows the opposite relationship of ↓genetic variance=↑athletic variance. Answer (B) shows the appropriate relationship of ↑genetic variance=↑athletic variance. However, note that the data points are tightly grouped. The passage gave us a correlation coefficient of .4 (r=.4). The closer the r value to 1, the tighter the grouping of the data points. Answer (C) also shows the opposite relationship of ↓genetic variance=↑athletic variance. Answer (D) correctly shows the relationship of ↑genetic variance=↑athletic variance. We also see that the data points are loosely packed which is consistent with the r value of .4.

Question 3: C

Question three proposes a situation where we repeat the study and obtain a different p-value. What does the p-value indicate and how do we interpret its value? (The following is a simplified summary) P-values represent the probability that the results of a statistical test were due to a true(statistically significant) relationship between two variables or random chance. The magic number for p-values is typically .05. If a calculated p-value is greater than .05, there is a low probability that a true relationship exists, and it is likely the observed results were due to random chance. If the p-value is less than .05, it is likely that the observed results are not due to random chance and a true relationship exists between the tested variables.

Now that we have discussed the p-value, let's return to the question. What has changed in this question from the original experiment? The p-value has changed from .07 to .03. What is the significance of this? We see that in the original experiment the .07 p-value is greater than .05, suggesting that the observed results were likely due to random chance and statistically significant relationship did not exist. In the new trial, the .03 p-value is less than .05, suggesting that a statistically significant relationship DOES exist and the results are NOT due to random chance. This reasoning matches up perfectly with answer (C).

Answer (A) suggest the original researches made a mistake. We have no reason to believe that either groups made a mistake. The only new piece of information the question supplies is the new p-value and the correct answer should somehow relate to this. Answer (B) suggests genetic variance CAUSES differences in athletic ability. This is a very strong statement and is too extreme. What the new results suggests is a statistically significant CORRELATION. Remember that correlation does not imply causation. Causation is gnerally very difficult to prove. Answer (C) is correct as discussed above. Answer (D) suggests that outliers played a role in the different p-values. Neither the passage nor the question mentions outliers. This answer is OOS.

Question 4: B

This question asks us to identify the correct statement regarding the independent variable in the study. What the independent variables in this study? Our independent variables in this case are the degree of relatedness between individuals. This is an example of a categorical variable. We have three different categories that can't be quantified (identical twins, separated identical twins, fraternal twins) What is the dependent variable? The dependent variable (the variable we are measuring) is athletic skill. What do the different independent variables allow us to do? By having identical twins raised together and another group of identical twins raised apart. We are controlling for environmental influences. If identical twins raised in different settings show similar athletic skills, we can reason that genetics plays a significant role in athletic ability. If we only looked at identical twins raised in the same environment, we couldn't be sure if observed similarities in skill we due to similar genes or similar environments.

Answer (A) suggests the independent variable is continuous and the dependent variable is categorical. This is an opposite answer choice. As discussed above the independent variable are the different twin groups and are categorical. The dependent variable is athletic skill. It is quantifiable and continuous. Answer (B) reflects what we discussed above and is the correct answer. Answer (C) suggests that the independent variable reflects fitness. Fitness is not discussed in this passage and is OOS. Answer (D) suggest the independent variable was measured by assessing genomes and alleles. This was not discussed in the passage and is OOS.

Question 5: A

This questions tells that a new experiment found that parental encouragement is highly correlated with athletic ability later in life. Additionally, it tells us that parental encouragement is more highly correlated with athletic ability than genetic variability. The question asks which of the provided groups would have greatest difference in athletic skill. Previewing the answer choices shows us that we are dealing with various combinations of two variables: 1) types of twins and 2) similar or different environment. Based on the information provided in the question stem, we can reason that twins raised apart would show greater athletic variance than those raised together allowing us to eliminate answers (B) and (D). (Those raised apart would have different parents, which the question tells us is highly correlated with athletic ability). Will fraternal (A) or identical (C) twins show greater variance in athletic ability. From the passage, we know that greater genetic variance is correlated with greater athletic variance. Because fraternal twins have greater genetic variance than identical twins, (A) will be the best answer.

Passage II (Questions 1-7)

Passage 2 is another experimental passage. It introduces the topic of learning, specifically serotonin's involvement in fear based learning. It goes on to describe an experiment with two groups of patients: serotonin depleted and a control group. Patients were shown a stimulus, and randomly punished with temperature increases on their skin. Skin conductance was taken as a measurement of fear response. A student performed a second experiment where he gave one group an excess of serotonin and measured heart rate.

Passage Outline

Paragraph 1: Increased serotonin may be involved in prediction error fear learning

Paragraph 2: Fear experiment. TRP- group vs control. Skin conductance=fear measurement

Paragraph 3: No sig. difference in reaction times. Control=↑ amygdala activity

Figure 1: Skin conductance vs. trial #. Control group ↓skin conductance after a point

Paragraph 4: 2nd experiment. TRP excess vs. control. ↑HR=↑ fear

Figure 2: Histogram of HR before and after meals.

Question 1: B

This question asks what conclusion can be made based on the first study. Before looking at the answers, let's see if we can make a prediction. What were the results of the study? No conclusions or relationships were given (that's what these questions are for!!) Let's look at the experimental design.

The study wanted to look at how serotonin (or lack of it) affected prediction error in fear learning. Prediction error is how the brain fine tunes its response to a stimulus.The study looked at a TRP- group and a control group. Why deplete TRP? Recall in paragraph 2 we are told that TRP deprivation will also cause decreased serotonin activity. The patients were randomly shown one of two pictures, four seconds later their skin temp/fear was measured, and 4 seconds after than were randomly given a pain stimulus. The important point here is that the painful stimulus was **random**.(More on this later)

At the beginning of the experiment both groups quickly began to have increased skin conductance following looking at the picture. Their brains saw that after looking at a picture, pain sometimes occurred and they began to anticipate fear following the looking at the picture. However, after a while we see that the control group's skin conductance begins to decline, while the TRP- group does not. Why is this happening? Because the painful stimulus is **random**, over time the brain is learning that it only gets hurt **sometimes** after looking at a picture, not **all the time** and thus its anticipation of pain(skin conductance) decreases over time. Why doesn't the TRP- make this connection? The TRP- groups are serotonin deficient, thus the prediction error pathway does not function properly, and they fail to learn that viewing a picture is not always associated with pain, and their anticipation of pain remains high.

After this lengthy discussion, we can make a prediction that decreasing serotonin impairs the brain's ability to fine tune its fear response. Answer (B) matches well with this conclusion.

Answer (A) suggests TRP deprivation may disrupt the prediction error pathway for anticipation of a reward. This answer may seem enticing, but it is discussing learning by reward NOT learning by fear/punishment as was discussed in the passage.

Answer (B) correctly states that when serotonin depleted, patients have a decreased ability to extinct their fear response to inconsistent (random) stimuli.

Answer (C) suggests that TRP deprivation impairs the ability to develop fear response to a novel (new) stimulus. Again, this seems tempting, but remember that this study was looking at serotonin's role in prediction error, the ability to fine tune responses. The patients in this study had no problem developing a fear response to a NEW stimulus (they quickly began to anticipate fear following picture viewing). Rather, they were impairing in decreasing this fear response as time went on and should have seen that pain administration was random.

Answer (D) states that serotonin is responsible for the regulation of physical and emotional response to adverse stimuli. Again, this may seem tempting, but it is too broad. All we know is that serotonin is involved in the prediction error aspects of fear based learning. We can't support claims regarding its involvement in regulation, physical symptoms, or emotional symptoms. Conclusions based on experimental data will tend to be very narrow and specific to what was actually measured.

Question 2: A

This question asks about the distribution of the students results. Let's try to make a prediction here. What do you notice looking at his results? Are they normally distributed? A quick glance shows that they are not a perfect bell curve. It's clearly skewed, but is it skewed left or right? The direction of skew refers to the **side of the tail**. Here we see our graphs have tails on the left, so we can predict that our answer should be left (or negative) skew.

Answer (A) perfectly matches our prediction. Answer (B) is opposite. A right skewed graph would show a tail on the right. Answer (C) The average (mean) and median are only the same when the graph is normally distributed. As our graphs are clearly skewed, this cannot be true. Left skewed graphs typically have a median that is greater than the mean. Answer (D) suggests the left graph has a higher standard deviation that the left. Both graphs have roughly the same shape and range. Furthermore, they both have the same sample size. Standard deviation is a measure of spread, and both graphs appear to be spread very similarly. We can safely say they likely have very similar SD without any lengthy calculations. Increasing the sample size may result in shrinking the standard deviation.

Question 3: C

This question asks what can be conclude by the second experiment in the passage. In this experiment, the student reasoned that increasing serotonin should result in improved fear learning. He measured heart rates to measure fear both before and after meals (he reasoned that after TRP heavy meals, serotonin should be increased).

What did his results show? Looking at his graphs, we see two histograms with roughly the same. Additionally, the before and after HR don’t show any significant or consistent patterns. What can we conclude? The student hypothesized that increasing serotonin would result in increased fear learning. Here, we fail to see increasing in HR (a measure of fear) after serotonin heavy meals, and thus the student can’t support his theory. (Additionally, he failed to have a pain stimulus, so he wouldn’t be able to link any increases in heart rate to fear learning, unless someone was deathly afraid of a turkey dinner!!)

Answer (A) suggests that food can partially account for changes in resting heart rate. Looking at the graphs, we see that we are simply given a histogram for heart rates before and after meals. All this tells us is how many students had heart rates at various frequencies. It does not pair data, that is, we can’t see the before heart rate and after heart rate of a given student. Without being able to see the before and after heart rates for individuals, we cannot assess the impact of food on HR.

Answer (B) suggests a significant difference exists in the dependent variable between conditions. The dependent variable here was heart rate. Without do any calculations, we can see that serotonin meal heart rates are roughly the same in frequency as the average meal heartrates.

Answer (C) suggests that the results are inconsistent with the hypothesis. His hypothesis was that heart rates should increase after a serotonin heavy meal. This was not observed, thus making (C) the best answer.

Answer (D) suggests that no conclusions can be made because the variables weren't operationalized. Operationalized variables are basically just variables that are quantifiable and measurable. Heart rate is certainly something measurable so we can say it is operationalized. The student probably can't make any conclusions from this experiment, but NOT because of non-operationalized variables.

Question 4: B

This questions asks what the first step of starting a new scientific investigation should be. The first step of an investigation should always be reviewing the available literature. This is done to ensure that the question you are investigating hasn't already been answered.

Answer (A) forming a hypothesis should be done after the available literature has been reviewed. Answer (B) is the first step in starting a new investigation. Answer (C) deciding on an experimental design should be done after forming a hypothesis. Answer (D) applying for a research grant would not be necessary for a student conducting an experiment for a school paper.

Question 5: A

This questions asks us what is true about reaction time in the experiment. Let's look at each answer choice.

Answer (A) is correct. The dependent variable is the variable that the study is measuring. Multiple dependent variables were measured, including reaction time, skin conductance, and fMRI activity. Answer (B) incorrectly suggests that reaction time is an independent variable. The independent variable is the variable that is controlled or manipulated by the study designers. The independent variable was serotonin status. Answer (C) incorrectly states that reaction time was a control factor. Controlled variables are held constant over the course of an experiment. Answer (D) suggests it was unnecessary. As reaction time was measured, it was an independent variable and certainly not unnecessary.

Question 6: D

This question asks about the use of temperature increases in the study. When were patients administered ↑ in temperature? The passage tells us that patients were **sometimes and sometimes not** administered pain following a visual stimulus. In this case, the visual stimulus is the conditioned stimulus. A conditioned stimulus is one that initially not associated with a response, but that later is. (Initially, seeing a picture did not evoke a fear response, but later did). An unconditioned response is one that naturally triggers a response. In this case, increases in temperature naturally elicited an anticipatory fear response.

Reinforcers (both positive and negative) serve to increase the probability of a behavior. Punishments, on the other hand, serve to decrease the probability of a behavior. Both punishments and reinforces are types of operant conditioning. Because this experiment was not dealing with increasing or decreasing frequency of behaviors, punishments and reinforces can’t be correct.

Answer (A) suggests that the temperature increase is a punishment. Punishments serve to decrease a behavior. This experiment was an example of classical conditioning where a response is learned to be associated with stimulus. There was no mention of increasing or decreasing a behavior. Answer (B) suggests a negative reinforcer. As with punishments, reinforcers serve to change behavior. Reinforcers serve to increase a behavior. A negative reinforcer is when a negative stimulus is removed to increase a behavior i.e. scratching an itch. Removal of itch (negative stimulus) increases scratching (behavior). Answer (C) suggests temperature increases served as conditioned stimuli. As discussed above, the visual stimulus was the conditioned stimulus because it was originally not associated with a response. Answer (D) is correct. Temperature increases naturally elicit an anticipatory fear response. the fear response occurs unconditionally.

Question 7: D

This question asks us to review four hypotheses and select the one that is not testable. A testable hypothesis should narrow and focused, and have easily measurable variables.

Answer (A) suggests evaluating which of two drugs is more effective at treating nausea. We have an independent variable (type of drug), and a dependent variable (effectiveness, which can easily be quantified i.e. frequency of nausea) which are both measurable.The drug that results in the lower frequency of nausea can be said to be more effective.

Answer (B) suggest testing a drug vs. placebo for effectiveness in treatin panic attacks. As with (A), we have an independent variable (drug or no drug) and a dependent variable (number of panic attacks) which are both measurable. If the drug significantly reduces panic attacks, it can said to be effective.

Answer (C) suggests testing a drug's ability to reduce intensity of auditory hallucinations. Here it is implied that we would be comparing the drug group to placebo. Intensity of hallucinations, while subjective, can be quantified by asking patients to rate them on a numerical scale (i.e 1-10). Comparing the intensity rating between the drug group and a placebo group would allow you to test this hypothesis.

Answer (D) suggests testing whether or not a drug is the **best** at reducing intensity and severity. We can certainly test IF drug A reduces severity and intensity of headaches, but showing it is the BEST remedy would be difficult. To prove it was the best, we would have to evaluate all other remedies for headaches, which would be very difficult. Additionally, we have two dependent variables (severity and intensity). If one remedy greatly reduced severity but only mildly reduced intensity while another remedy mildly reduced severity and greatly reduced intensity, how would we determine which one was **best**? (We couldn't) A better hypothesis would be **drug A reduces severity and intensity of headaches** or**drug A reduces severity and intensity of headaches more than drug B**.

Passage III (Questions 1-6)

This passage introduces the concept of color constancy. It tells us color constancy is the ability for perceived colors to stay the same in different lightings. It is thought that the brain evolved to do this in natural lighting. This theory was tested. Subjects were shown an object under certain lighting conditions. They were shown the objects again in the same lighting and a new lighting and asked to identify which one matched the original. They constructed several graphs summarizing their results. Subjects had greatest accuracy matching green colors and lowest when matching blue.

Passage Outline

Paragraph 1: Color constancy-perceived color stays same in different lighting. Evolved in natural light.

Paragraph 2: Study-changed lighting, measured accuracy of matching colors.

Paragraph 3: Contents of scene did not change matching accuracy

Figure 1: Accuracy by illumination type. Green is highest accuracy

Paragraph 4: Curve constructed to include area where 75% matching occurred

Figure 2: Accuracy vs distance from target color. Green had highest accuracy

Figure 3: Illumination curve

Question 1: A

This question asks which of the choices is a problem with the design of the study. Predcting an answer here would involved a thorough evaluation of the entire study which would take some time.Here it is best to evaluate each answer choice.

Answer (A) suggest the hypothesis can’t be tested. What is the hypothesis. In paragraph 1 it tells us the hypothesis is that the mechanism for color constancy is optimized for natural light due to its evolution under such conditions. While we can certainly test whether constancy is optimized for natural light (as was done in the experiment), it would be very difficult/impossible to test whether or not this is due to its evolution under such conditions. The problem with the statement is the clause regarding evolution. IT would be very difficult to replicate or model evolution as it is a complicated process occurring over great amounts of time.

Answer B) suggests the experiment doesn't test the quantitative aspects of the hypothesis. What are the quantitative aspects in this case? In this case, the quantitative aspects are optimization, which is measured by match accuracy, and color, which can be quantified by wavelengths. (Wavelengths aren't reported, but colors represent quantifiable wavelengths.) Both color and match accuracy are measured.

Answer (C) suggest the experiment is not beneficial and has no relevant. First off, the extreme language here should raise some red flags. The question is also asking for a potential problem with the study design. The benefit or relevancy of the study has no bearing on its design.

Answer (D) suggest the study didn't control for absolute differences in perception between participants. Absolute differences in perception were not controlled, but this won't be a problem as this study is concerned with relative differences.

Question 2: C

This question asks what conclusion can be drawn from the study. From the fig 2b, we see match accuracy was highest in green lighting and lowest in blue lighting. We can interpret this to mean that in green light, colors remained less constant (people could perceive a difference, so their match accuracy was higher), and in blue light they were more constant (people couldn’t perceive a difference, so their accuracy was lower). The passage tells us blue light is associated with natural light, while green is typically seen in artificial light. Thus, we can conclude that color constancy is more pronounced under natural light than artificial light. This matches nicely with choice C.

Answer (A) suggest we can conclude that evolutionary processes play a role in the mechanism behind color constancy. The experiment measured nothing that could be said to reflect evolutionary processes. Furthermore, designing an experiment to test or measure evolutionary influences would be very difficult. Answer (B) is opposite of the correct answer, choice (C). Answer (C) is correct for the reasons discussed above. Answer (D) wrongly states that color constancy is unrelated to lighting conditions. If this was true, the blue and green matching accuracies should have been the same.

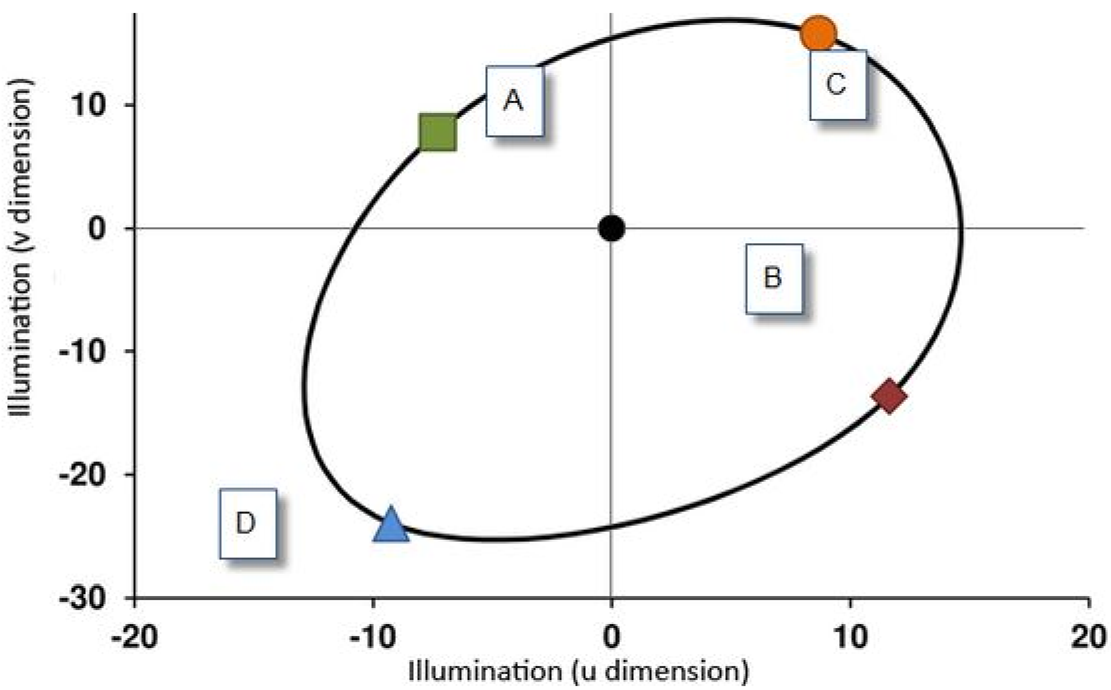
Question 3: A

This question asks which structure is most likely responsible for color constancy. The first paragraph mentions that the proposed mechanism for color constancy in the brain is optimized for natural light. This suggests that the structure responsible is a cerebral structure. Of the answers available, primary visual cortex is the mostly likely to be involved.

Answer (A) is correct. The primary visual cortex is the major site of visual processing, including color. Answer (B) is unlikely as the passage suggests the structure responsible is in the brain, not the eye. Answer (C) is incorrect. Although the superior colliculus is involved in visual processing, its major visual role is in eye movements and gaze, not color discrimination. Answer (D) is incorrect. The LGN is involved in visual processing, but mainly in temporal and spatial processing, not color discrimination.

Question 4: D

Asks where on Fig 2c would we expect to find the highest accuracy of discrimination. This graph shows the boundaries containing the area where a 75% match accuracy was achieved compared to neutral light. It tells us that the middle point is neutral illumination. From Fig 2b, we see that as we move away from target chromaticity, match accuracy increases. Thus, as we move further away from the center of Fig 2c, we would expect match accuracy to increase. Plotting the answer choices, we see that choice (D) is the only one outside the circle, thus it must be greater than 75%, and will have the highest accuracy.



Question 5: C

This question tells us that a point on the graph is inside the just noticeable difference threshold for neutral illumination. This means that no perceivable difference will be observed under the lighting conditions this point represents. What will we expect the accuracy to be? In the experiment, subjects were shown two objects and asked which one matched the original. If no difference can be perceived between the two objects, we would expect that subjects would match correctly 50% of the time.

Alternatively, we can look at Fig 2b. We see that at 0 distance from target chromaticity (neutral illumination), match accuracies are all 50%. Answer (C) matches exactly to our prediction.

Question 6: A

This question asks us to identify the purpose of the experiment. We know that the experiment was investigating color constancy. What variables we were testing? We were looking at how different lighting conditions affected color matching accuracy. The correct answer should reflect this.

Answer (A) correctly thats that the experiment was done to determine the extent to which variations in lighting conditions predict color constancy. This matches well with our prediction and what was actually performed in the study. Answer (B) suggests that the experiment shows the mechanism of color constancy evolved under natural selection. While its probably true that color constancy evolved via natural selection, our experiment says nothing about the evolution of color constancy or the process behind it. Answer (C) incorrectly suggests that the experiment was done to show that natural light should be preferred indoors. The purpose of the experiment will typically be narrow and specific and reflect the specific variables measured in the experiment. The design of interior spaces was never discussed. Answer (D) is opposite of what was found in the study. Our study showed that artificial light made it easier to discriminate between the colors of object.

Discretes (Questions 1-6)

Question 1: C

Question 1 asks is to determine the types of graphs shown in the figure. The **x** axis on the left graph is seen to be increasing by units of increasing orders of magnitude. This is known as a logarithmic scale. The **y** axis seems to be following a typical linear scale. Because one axis is a logarithmic scale and one is linear, we call this a semi-log plot. Both axes on the right are on a logarithmic scale so we call this a log-log plot.

Answer (A) suggests that the graphs show linear relationships. While both show straight lines,, the graph on the left is not a linear relationship. Linear relationships are characterized by a constant change or slope. However, because one axis is on a logarithmic scale, it will be increasing exponentially, and the slope will actually be constantly changing. This is actually an exponential relationship. Semi-log lots are often used to visualize exponential relationships. Answer (B) is opposite of the correct answer. Answer (C) is correct as discussed above. Answer (D) suggests that both graphs are exponential relationships. The left graph has an exponential relationship as its slope is not constant over time, if the **x** axis is plotted on a linear scale. The right graph is linear relationship. Both axes are logarithmic, but they both increase at the same rate, so the slope will be constant.

Question 2: D

Question 2 asks which participant has the lowest standard deviation. Standard deviation tells us how spread out our data points are from the mean. Calculating the standard deviation is a lengthy process so let’s see if we can make any estimates by just looking at the samples. Do any of the participants seem to be more or less spread out? While larger range does not always equal larger standard deviation, it can be a rough estimate. We see that participant 1 has a range of 5, participant 2 has a range of 4, participant 3 has a range of 10, and participant 4 has a range of 3. Looking at participant 3 more closely, we see that it only contains 4 unique values. Based on this, it appears that the data is closely group, and will likely have the lowest standard deviation. Answer (A) is more spread out and has more unique values. It is more spread out that participant 4. Answer (B) has a larger range than participant 4. Answer (C) has a larger range than participant 4. Answer (D) is correct.

Question 3: C

This question asks us to compare the median and mean of participants 1 and 2. We will need to calculate the mean and median for both. The mean is simply the average. To get this, we divide the sum of the values divided by number of trials. We can approximate by dividing by 10 instead of 9 to make the math easier on us.

Participant 1 mean= 61/9. This number will be slightly greater than 61/10, or 6.1. Participant 2 mean=70/9. This number will be slightly greater than 70/10, or 7.

To find the median, we need to reorder our data and find the middle most number. Participant 1 median=4 4 5 6 ‘’’8’’’ 8 8 9 9 Participant 2 median=6 6 7 7 7 ‘’’9’’’ 9 9 10

Comparing our values, we see that Participant 1 has a higher median and a lower mean compared to participant 2. Answer (C) is the best choice.

Question 4: B

This question asks if trial 8 for participant 3 should be removed as an outlier. In general, outliers can be removed if they are greater than 1.5 interquartiles from the mean. To find out if our data point meets this criteria, we first must separate our data set into quartiles.

First we need to rearrange our values in chronological order and find the median. Next, we determine Q1 and Q3 by splitting the upper and lower halves in half. Because our Q1 and Q3 fall between two values, we simply take the average of the numbers on either side to them to determine their value.

Our interquartile range is simply the difference between Q1 and Q3.

IQR=Q3-Q1 IQR=8.5-4 IQR=4.5

Now we multiply our IQR by 1.5

4.5*1.5=6.75

Adding this to Q3 gives us the boundary at which we should exclude outliers.

6.75+8.5=15.25.

Because 16 is outside of 15.25 (calculated to be Q3+(1.5*IQR), we can safely remove 16 as an outlier. Answer (B) is consistent with our work.

Answer (A) is incorrect. Data points should not be excluded based solely on being outside two standard deviations of the mean. Doing so would exclude about 5% of all data points. Answer (B) is correct as discussed above. Answer (C) is opposite. 16 is outside 1.5 IQRs from Q3. Answer (D) suggest removing a data point decreases a study's validity. Generally, decreasing sample size will decrease the power of a study, not decrease its validity.

Question 5: D

This question asks what would happen if we combined both the graphs shown in the figure. The two graphs are roughly normal in distribution but have different ranges, averages, and modes. Combining them would result in a wider graph with two humps, or modes. We call this distribution bimodal.

Answer (A) suggests the standard deviation would double. This suggest that the data in the combined graph would be twice as spread out as in the originals. While the standard deviation will increase, because the graphs will share significant overlap, the increase will be less than double the originals. Answer (B) suggests the combined mean would remain the same as the originals. This is not possible as the graphs start with different means. Answer (C) suggests the *n* at each point would increase, but other statistical measures would remain the same. Only points with overlapping values would increase.

Non overlapping values (such as 40 and 58) would stay the same. Answer (D) correctly states that the new graph will be bimodal.

Question 6: B

This question asks which principles of experimental design the given hypothesis would violate. Let’s examine each one separately.

Answer (A) Is this experiment feasible? What would you have to do in order to test whether changing the gravitational constant of the universe would change the safe dropping height of rats? You would actually have to change the universal gravitational constant of the universe!! Unless you are a superhero, this is not a feasible option. Answer (B) is correct. Would it be interesting to see how high you could drops rats without hurting them in a universe with an altered gravitational constant? From a purely academic standpoint, many may say yes. Answer (C) Is this experiment ethical? To determine the height at which rats no longer sustain injury, rats would have to be dropped from heights that WOULD cause them injury. No clear benefit exists from obtain this knowledge, making this highly unethical. Answer (D) Is this experiment relevant? There are no obvious practical applications that will come of testing this hypothesis.