In an experiment designed to test cognitive dissonance, researchers asked adult participants to rate their beliefs about eating meat on a 1-5 scale: “I believe the consumption of meat is 5: healthy and ethical; 4: somewhat healthy and ethical; 3: neither healthy nor unhealthy and neither ethical nor unethical; 2: somewhat unhealthy and unethical; 1: very unhealthy and unethical.” Participants were then randomly assigned one of two essays to write – either a one-page essay defending a vegan lifestyle or a one-page essay defending meat-eating. Each participant was randomly assigned to one of five groups: Group 1 wrote the essay defending veganism and was paid $10; group 2 wrote the essay defending veganism and was paid $300; group 3 wrote the essay defending meat consumption and was paid $10; group 4 wrote the essay defending meat consumption and was paid $300; and group 5 was not asked to write any essay and was not paid.

Two days later, participants were asked to fill out the survey again about their attitudes about eating meat. The results are summarized below.

<table>
<thead>
<tr>
<th>Initial Attitude</th>
<th>Group 1</th>
<th>Group 2</th>
<th>Group 3</th>
<th>Group 4</th>
<th>Group 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 (meat okay)</td>
<td>4.4</td>
<td>4.8</td>
<td>4.95</td>
<td>4.96</td>
<td>4.9</td>
</tr>
<tr>
<td>4</td>
<td>3.3</td>
<td>3.75</td>
<td>4.1</td>
<td>4.08</td>
<td>4.01</td>
</tr>
<tr>
<td>3</td>
<td>2.6</td>
<td>2.9</td>
<td>3.32</td>
<td>3.2</td>
<td>3.05</td>
</tr>
<tr>
<td>2</td>
<td>1.6</td>
<td>1.95</td>
<td>2.38</td>
<td>2.15</td>
<td>2.11</td>
</tr>
<tr>
<td>1 (meat not okay)</td>
<td>1.1</td>
<td>1.05</td>
<td>1.19</td>
<td>1.1</td>
<td>1.1</td>
</tr>
</tbody>
</table>

**Table 1** Results of the essay-writing exercise on participants’ beliefs. Data reported as the mean score on the 1-5 scale for all participants based on initial response and group assignment.

In a separate experiment, researchers placed five year old children in a room with a number of toys, including one especially tempting toy (the most popular children’s toy of that Christmas season). One group of children were given no instructions about what to play with, and when left alone a strong majority of children selected the popular toy. The second group was told they could play with any toy but the popular one, and told they would be mildly punished if they disobeyed. The third group was told they would be severely punished if they played with the popular toy. After leaving each group alone for ten minutes, the researchers returned and told the children they could play with any toy they liked.

In group 3 (severe punishment), most children elected to play with the popular toy after they were told they were allowed to. In group 2 (mild punishment), however, the majority of children still avoided playing with the popular toy, even after they were permitted to.
1. Which of the following identifies a weakness in the experimental design of the first experiment?

A) The amounts of money chosen do not reflect a constant marginal gain in value, given the differences in socioeconomic status among participants.
B) Participants were asked to self-report their attitudes about meat consumption rather than an objective assessment.
C) A five-point scale is too crude to make determinations about an issue as nuanced as food ethics.
D) Both the initial and follow-up survey conflate two factors that may be different and have different effects on cognitive dissonance.

2. The participants in the second experiment differ from those in the first in that:

A) they did not experience cognitive dissonance.
B) their moral reasoning likely operated on a preconventional level.
C) they did experience cognitive dissonance.
D) their cognitive development was limited to the sensorimotor stage.

3. The results from experiment 1 suggest that those in group 3 who initially responded with a 1, 2, or 3 on the survey:

A) experienced increased cognitive dissonance after the second survey.
B) resolved their cognitive dissonance by increasing certain behaviors.
C) resolved their cognitive dissonance by changing their cognitions.
D) decreased their ethical behavior after the essay writing task.

4. Which of the following is NOT a method for resolving cognitive dissonance?

A) Changing one’s behaviors
B) Adding new cognitions
C) Projection of dissonant attitudes
D) Denial of the truth of the conflicting information

5. The results from experiment 1 suggest that those in group 2 who responded with a 3, 4, or 5 on the initial survey experienced which of the following?

A) Less cognitive dissonance than those in group 1 due to external justification of behavior
B) No cognitive dissonance because they were writing an essay that was consonant or irrelevant to their attitude
C) More cognitive dissonance than those in group 1 due to their willingness to write an essay opposing their views in exchange for a large sum of money
D) An increased willingness to not be truthful with the researchers
Passage 1 Explanation

In an experiment designed to test cognitive dissonance, researchers asked adult participants to rate their beliefs about eating meat on a 1-5 scale: “I believe the consumption of meat is 5: healthy and ethical; 4: somewhat healthy and ethical; 3: neither healthy nor unhealthy and neither ethical nor unethical; 2: somewhat unhealthy and unethical; 1: very unhealthy and unethical.” Participants were then randomly assigned one of two essays to write – either a one-page essay defending a vegan lifestyle or a one-page essay defending meat-eating. Each participant was randomly assigned to one of five groups: Group 1 wrote the essay defending veganism and was paid $10; group 2 wrote the essay defending veganism and was paid $300; group 3 wrote the essay defending meat consumption and was paid $10; group 4 wrote the essay defending meat consumption and was paid $300; and group 5 was not asked to write any essay and was not paid.

Key term: cognitive dissonance
Opinion: participants gave their opinion on meat-eating
Cause-and-effect: participants wrote an essay for or against meat eating and were paid a little or a lot

Two days later, participants were asked to fill out the survey again about their attitudes about eating meat. The results are summarized below.

<table>
<thead>
<tr>
<th>Initial Attitude</th>
<th>Group 1</th>
<th>Group 2</th>
<th>Group 3</th>
<th>Group 4</th>
<th>Group 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 (meat okay)</td>
<td>4.4</td>
<td>4.8</td>
<td>4.95</td>
<td>4.96</td>
<td>4.9</td>
</tr>
<tr>
<td>4 (meat okay)</td>
<td>3.3</td>
<td>3.75</td>
<td>4.1</td>
<td>4.08</td>
<td>4.01</td>
</tr>
<tr>
<td>3 (meat okay)</td>
<td>2.6</td>
<td>2.9</td>
<td>3.32</td>
<td>3.2</td>
<td>3.05</td>
</tr>
<tr>
<td>2 (meat okay)</td>
<td>1.6</td>
<td>1.95</td>
<td>2.38</td>
<td>2.15</td>
<td>2.11</td>
</tr>
<tr>
<td>1 (meat not okay)</td>
<td>1.1</td>
<td>1.05</td>
<td>1.19</td>
<td>1.1</td>
<td>1.1</td>
</tr>
</tbody>
</table>

Table 1 Results of the essay-writing exercise on participants’ beliefs. Data reported as the mean score on the 1-5 scale for all participants based on initial response and group assignment.

Table 1 Attitudes remained relatively constant but that groups 1 and 3 (the $10 groups) had a bigger shift in response to writing their essays. We see that the biggest impact was on the group that felt meat-eating was okay and who were then paid $10 to write an essay defending veganism.

In a separate experiment, researchers placed five year old children in a room with a number of toys, including one especially tempting toy (the most popular children’s toy of that Christmas season). One group of children were given no instructions about what to play with and when left alone a strong majority of children selected the popular toy. The second group was told they could play with any toy but the popular one, and told they would be mildly punished if they...
disobeyed. The third group was told they would be severely punished if they played with the popular toy. After leaving each group alone for ten minutes, the researchers returned and told the children they could play with any toy they liked.

**Key terms: five year old children, tempting toy**

**Contrast:** one group could play with any toy, one group was told mild punishment if they played with the popular toy, one group was told severe punishment

**Cause-and-effect:** after the initial threat of punishment, they were then let play with any toy at all

In group 3 (severe punishment), most children elected to play with the popular toy after they were told they were allowed to. In group 2 (mild punishment), however, the majority of children still avoided playing with the popular toy, even after they were permitted to.

**Contrast:** children who were only given a mild threat of punishment still chose not to play with the toy even when allowed to; other children played with the popular toy once permitted

1. Which of the following identifies a weakness in the experimental design of the first experiment?

A) The amounts of money chosen do not reflect a constant marginal gain in value, given the differences in socioeconomic status among participants.

B) Participants were asked to self-report their attitudes about meat consumption rather than an objective assessment.

C) A five-point scale is too crude to make determinations about an issue as nuanced as food ethics.

D) Both the initial and follow-up survey conflate two factors that may be different and have different effects on cognitive dissonance.

The self-reporting survey used conflates whether eating meat is “healthy” and whether it is “ethical”. These are two very different considerations and people may have different attitudes about those two factors. In addition, differences in those attitudes may change how they react to the essay-writing exercise.

A: The difference between $10 and $300 was intended to be very different values, so asserting that they do not represent a constant gain in value is not a weakness in the experiment.

B: Many social science protocols require self-reporting. This is a standard practice, not a weakness.

C: An inventory that assesses basic agreement or disagreement can effectively use a five-point scale.
2. The participants in the second experiment differ from those in the first in that:

A) they did not experience cognitive dissonance.
B) their moral reasoning likely operated on a preconventional level.
C) they did experience cognitive dissonance.
D) their cognitive development was limited to the sensorimotor stage.

The second experiment involved small children. In Kohlberg’s stages of moral reasoning, small children tend to operate at a preconventional level of moral reasoning. Adults typically employ conventional or post-conventional moral reasoning.

A: The fact that children who were not threatened with a harsh punishment chose later to not play with the popular toy suggests that the children experienced cognitive dissonance and so had to adjust their internal attitude (“well I didn’t want to play with that toy anyway”) so that the toy was not appealing even after the threat of punishment was removed.
C: While they did experience cognitive dissonance, this was not a way in which they differed from the adults, who also experienced cognitive dissonance.
D: Piaget’s stages of cognitive development suggest that the sensorimotor stage is limited to 0-2 year olds.

3. The results from experiment 1 suggest that those in group 3 who initially responded with a 1, 2, or 3 on the survey:

A) experienced increased cognitive dissonance after the second survey.
B) resolved their cognitive dissonance by increasing certain behaviors.
C) resolved their cognitive dissonance by changing their cognitions.
D) decreased their ethical behavior after the essay writing task.

Group 3 was tasked with defending meat consumption, and those who initially answered 1, 2, or 3 did not initially express an opinion that meat eating was healthy and ethical. On the repeat survey, those numbers drifted upwards considerably, suggesting that some people resolved their cognitive dissonance (“I wrote an essay defending meat-eating for only ten bucks, but I didn’t think eating meat was okay.”) by changing their thoughts about whether eating meat was okay.

A: The assessment of cognitive dissonance comes through changes in the survey results between the first and second survey. We’re given no data about what happens after the second survey.
B, D: The passage doesn’t address behaviors exhibited by participants, only survey responses about attitudes.

4. Which of the following is NOT a method for resolving cognitive dissonance?

A) Changing one’s behaviors
B) Adding new cognitions

C) **Projection of dissonant attitudes**

D) Denial of the truth of the conflicting information

Resolving cognitive dissonance requires changing thoughts or actions to reduce the dissonance. One can change one’s behaviors to align with ideas (choice A), or add new ideas to reduce the dissonance (e.g. “I want to be on a diet but I ate that muffin. But that’s okay because it must’ve been a low-fat muffin.”) (choice B), or simply ignore the new, dissonant information (e.g. “I like this presidential candidate so this news story saying he did something I disapprove of must be wrong.”) (choice D). By process of elimination, that leaves choice C as the right answer to this “NOT” question.

Projection is an ego defense mechanism, rather than a method to reduce cognitive dissonance.

5. The results from experiment 1 suggest that those in group 2 who responded with a 3, 4, or 5 on the initial survey experienced which of the following?

A) **Less cognitive dissonance than those in group 1 due to external justification of behavior**

B) No cognitive dissonance because they were writing an essay that was consonant or irrelevant to their attitude

C) More cognitive dissonance than those in group 1 due to their willingness to write an essay opposing their views in exchange for a large sum of money

D) An increased willingness to not be truthful with the researchers

Group 2 had to write an essay defending veganism, but those who answered 3, 4, or 5 did not express a particular attitude that eating meat was wrong. Thus they likely experienced some cognitive dissonance, and we can see that they resolved this dissonance by changing their ideas – in general the data on a re-test gave lower scores than the first test. However, the change in scores was not as great as for group 1. Thus group 2 likely experiences less cognitive dissonance. The difference is that they were paid a much larger sum of money and so could justify their essay-writing behavior to themselves rather than experience unpleasant dissonance.

B, C: Group 2 did not experience more dissonance or a lack of dissonance, as can be seen from the data in table 1.

D: Nothing in the passage suggests that participants had a reason to lie or did so.
Weber's law presents an interesting exception in the case of sound. While other sorts of stimuli will have a constant just-noticeable difference (jnd) across the full range of perceptible stimuli (the change in stimulus intensity as a fraction of the original intensity is a constant), for sound this does not always hold true.

**Figure 1** The jnd as a function of intensity for a single pure tone and for white noise

**Figure 2** The jnd as a function of intensity for a recording of speech in a language understood by the listener, one not understood by the listener, and a recognizable non-speech sound (a cat's meow)
1. In studies of the just-noticeable difference, perception is measured in what way?

A) Sensation  
B) Discrimination  
C) Magnitude estimation  
D) Signal transduction

2. For the especially loud noises, subjects often report negative emotions such as anger after hearing several of the loud sounds. The James-Lange theory would posit that this emotional response:

A) precedes and causes a person to experience physiological arousal which then contributes to further unpleasant affect.  
B) occurs simultaneously and independently of the physiological arousal stimulated by the loud sounds.  
C) is a result of both physiological arousal and a cognitive appraisal of that arousal.  
D) follows from and is caused by the physiological arousal experienced as a result of the loud sounds.

3. For nearly every type of sound played, the just-noticeable difference dropped significantly near or above 130 dB. Which of the following is the most likely reason?

A) Above a certain intensity level, sound perception also occurs as a result of signal transduction directly through the skull rather than solely through the ossicles and organ of Corti.  
B) The threshold of pain is near or above 130 dB and the jnd for pain is much lower than for many other types of stimuli.  
C) Study participants were more attentive to the especially loud sounds as a result of the physiological arousal those sounds created.  
D) The distracting nature of the especially loud sounds made it more difficult for study participants to detect changes in stimulus intensity.
4. The just-noticeable difference for response to different intensity electric shocks is presented below. Which of the following is most likely true?

![Figure 2](image)

**Figure 2** The jnd for a series of electric shocks with the shock intensity scaled as a series of 10 arbitrary but equal-value units

A) Nociceptors are significantly more sensitive to variations in pain intensity than the auditory system is to variations in loudness.
B) Unlike auditory perception of white noise sound intensity, the perception of pain intensity generally follows Weber's law at lower levels.
C) The signal transduction mechanisms by which pain is experienced do not rely on the same ion-channel triggers as do those for sound.
D) An 11% increase or decrease in shock intensity will generally not be noticed by a person.

5. The experiment involved playing noises loud enough that some study participants may have experienced discomfort or even pain. For the experiment to be approved by the researchers’ institutional review board, they must have done all of the following EXCEPT:

A) Keeping the sound intensity well below the level at which each individual study participant will experience discomfort
B) Determining the least harmful or invasive protocol to achieve the study's results
C) Obtaining informed consent from the study participants prior to beginning the study
D) Treating study participants equally regardless of factors such as socioeconomic status, race, or gender
Passage 1 Explanation

Weber's law presents an interesting exception in the case of sound. While other sorts of stimuli will have a constant just-noticeable difference (jnd) across the full range of perceptible stimuli (the change in stimulus intensity as a fraction of the original intensity is a constant), for sound this does not always hold true.

Figure 1 The jnd as a function of intensity for a single pure tone and for white noise

Figure 2 The jnd as a function of intensity for a recording of speech in a language understood by the listener, one not understood by the listener, and a recognizable non-speech sound (a cat's meow)
1. In studies of the just-noticeable difference, perception is measured in what way?

A) Sensation  
**B) Discrimination**  
C) Magnitude estimation  
D) Signal transduction

Weber’s law asks a person to perceive two stimuli and then determine whether or not they are the same or different. Perceiving differences between two stimuli is discrimination.

A, D: Sensation and signal transduction refer to the raw physical process of taking in external stimuli, whereas Weber’s law relates to making judgments about them.  
C: Magnitude estimation would involve playing a single tone and asking the person to estimate its loudness. Weber’s law, however, concerns itself with the difference between two tones.

2. For the especially loud noises, subjects often report negative emotions such as anger after hearing several of the loud sounds. The James-Lange theory would posit that this emotional response:

A) precedes and causes a person to experience physiological arousal which then contributes to further unpleasant affect.  
B) occurs simultaneously and independently of the physiological arousal stimulated by the loud sounds.  
C) is a result of both physiological arousal and a cognitive appraisal of that arousal.  
**D) follows from and is caused by the physiological arousal experienced as a result of the loud sounds.**

The James-Lange theory of emotion asserts that emotions start from the body (physiological arousal) and that those bodily sensations cause our emotions.

B: This is closer to the Cannon-Bard theory of emotion.  
C: This is closer to the Schacter-Singer theory of emotion.

3. For nearly every type of sound played, the just-noticeable difference dropped significantly near or above 130 dB. Which of the following is the most likely reason?

A) Above a certain intensity level, sound perception also occurs as a result of signal transduction directly through the skull rather than solely through the ossicles and organ of Corti.  
**B) The threshold of pain is near or above 130 dB and the jnd for pain is much lower than for many other types of stimuli.**  
C) Study participants were more attentive to the especially loud sounds as a result of the physiological arousal those sounds created.
D) The distracting nature of the especially loud sounds made it more difficult for study participants to detect changes in stimulus intensity.

The level of sound intensity that will cause pain varies by individual, but typically around 130-140 dB is the pain threshold. At that point, participants are experiencing auditory and pain inputs, so their ability to discriminate between stimuli is going to change.

A: Human sound perception always goes through the hair cells of the organ of Corti. C, D: We have to reason to suspect that the louder sounds are making the study participants more or less attentive to the sounds themselves.
4. The just-noticeable difference for response to different intensity electric shocks is presented below. Which of the following is most likely true?

![Graph showing jnd for a series of electric shocks with the shock intensity scaled as a series of 10 arbitrary but equal-value units.]

**Figure 2** The jnd for a series of electric shocks with the shock intensity scaled as a series of 10 arbitrary but equal-value units

A) **Nociceptors are significantly more sensitive to variations in pain intensity than the auditory system is to variations in loudness.**
B) Unlike auditory perception of white noise sound intensity, the perception of pain intensity generally follows Weber’s law at lower levels.
C) The signal transduction mechanisms by which pain is experienced do not rely on the same ion-channel triggers as do those for sound.
D) An 11% increase or decrease in shock intensity will generally not be noticed by a person.

Notice the y-axis here; the jnd for pain is hovering just over 0.1 which is much less than that given on the y-axis in the sound studies. Thus it is reasonable to conclude that people are much more sensitive to variations in pain intensity.

B, C, D: These are all opposite statements. White noise sound detection does follow Weber’s law at lower levels (note the relatively flat slope in figure 1), 11% is detectable (note the jnd for pain hovers right around 0.11), and signal transduction for perceptions does rely on changes in ion-channel transport.

5. The experiment involved playing noises loud enough that some study participants may have experienced discomfort or even pain. For the experiment to be approved by the researchers’ institutional review board, they must have done all of the following **EXCEPT:**
A) Keeping the sound intensity well below the level at which each individual study participant will experience discomfort
B) Determining the least harmful or invasive protocol to achieve the study’s results
C) Obtaining informed consent from the study participants prior to beginning the study
D) Treating study participants equally regardless of factors such as socioeconomic status, race, or gender

Choices B, C, and D are all classic examples of the ethical principles that must guide experiments using human subjects. Non-maleficence (B), respect for autonomy (C), and respect for justice (D) are all requirements of ethical research. Human experimentation may involve some discomfort or even pain for the subjects, so choice A is not an absolute requirement, so long as researchers have absolutely minimized the pain involved.
The implicit association test assesses for implicit attitudes through a categorization task. Participants are presented with a computer screen displaying two words on the left side of the screen and two words on the right. The middle of the screen then flashes a word or image and the participant must click a button to indicate the appropriate category as quickly as they can.

A typical set up involves putting the categories “good” and “bad” on the sides of the screen (left vs. right determined randomly) and then categories like “male” and “female” or “rich” and “poor”. After going through several assignments, the category pairings are switched. So for example, a person might click the left button if an image is either “good or male” and the right button if the image is “bad or female” during round 1, and then have to click left for “good or female” and right for “bad or male” during round 2. The images or words presented unequivocally belong to one of these groups. For example, words like “disgust” or “agony” would be categorized as “bad” by 100% of participants, and the symbol for the men’s bathroom would be categorized as “male” by 100% of participants.

Researchers hypothesize that faster response times indicate an implicit bias in favor of the grouping. That is, if a person is able to categorize an image as “good or male” more quickly than he is able to categorize an image as “good or female”, this reveals an implicit sexism in favor of males.

The implicit assumption test was made available on the website of a prominent university and after several news stories, became very popular, with over 150,000 participants in the span of just a few months. The data showed the following results:

<table>
<thead>
<tr>
<th></th>
<th>Good</th>
<th>Bad</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slim</td>
<td>751 ms</td>
<td>1003 ms</td>
</tr>
<tr>
<td>Fat</td>
<td>1150 ms</td>
<td>633 ms</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Good</th>
<th>Bad</th>
</tr>
</thead>
<tbody>
<tr>
<td>Able</td>
<td>833 ms</td>
<td>998 ms</td>
</tr>
<tr>
<td>Disabled</td>
<td>1012 ms</td>
<td>710 ms</td>
</tr>
</tbody>
</table>

**Table 1a and 1b** The average delay (in milliseconds) that a person took to correctly categorize an image.

1. Which of the following correctly identifies a limitation of the data set used?

A) The size of the data set prevents the conclusions from having significant statistical power.
B) Because the test works on implicit associations, it is unable to provide insight about those who are consciously biased.
C) Recruitment through media discussion of the test, without the usual small payment to participants, means the data set would skew towards much higher ends of the socioeconomic ladder.
D) The self-selection of participants prevents the data from being generalizable to any particular population.

2. The procedure described in the passage should also include each of the following EXCEPT:

A) One or more training rounds in which the person only needs to categorize an image as “good” vs. “bad”, rather than having to be aware of two distinct categorizations at once.
B) Controls in which the two categories have no meaningful connection (implicit or otherwise), such as “up or red” vs. “down or green”.
C) Recruitment procedures to guarantee that equal numbers of male and female participants are gathered.
D) Subsequent data analysis that discards outlying data points as irrelevant (e.g. a latency of 150,000 ms that suggests the person got up and left the computer in the middle of the test).

3. The results from the experiment indicate that:

A) no implicit associations are associated with able-bodied versus disabled people.
B) study participants demonstrated a stronger implicit preference for slimness than against able bodied people.
C) a self-selected participant pool is more likely to have implicit biases than the general population.
D) study participants demonstrated a stronger implicit preference against fat people than against disabled people.

4. If study participants feel a mild sensation of disgust in response to a word or image associated with disabled people, the Cannon-Bard theory of emotion would assert that:

A) the physiological arousal and emotional sensation of disgust arise separately and independently in separated areas of the brain.
B) the emotion is the result of the brain assessing the context of the physiological arousal experienced in the body.
C) the emotion follows from and is directly caused by the physiological arousal experienced.
D) the emotion is a cognitive response which then causes autonomic reflexes generating the feeling of the affect.

5. The test is assessing:

A) unconscious discrimination.
B) conscious discrimination.
C) unconscious prejudice.
D) conscious stereotypes.
Passage 1 Explanation

The implicit association test assesses for implicit attitudes through a categorization task. Participants are presented with a computer screen displaying two words on the left side of the screen and two words on the right. The middle of the screen then flashes a word or image and the participant must click a button to indicate the appropriate category as quickly as they can.

Key words: implicit association test, two words, category

A typical set up involves putting the categories “good” and “bad” on the sides of the screen (left vs. right determined randomly) and then categories like “male” and “female” or “rich” and “poor”. After going through several assignments, the category pairings are switched. So for example, a person might click the left button if an image is either “good or male” and the right button if the image is “bad or female” during round 1, and then have to click left for “good or female” and right for “bad or male” during round 2. The images or words presented unequivocally belong to one of these groups. For example, words like “disgust” or “agony” would be categorized as “bad” by 100% of participants, and the symbol for the men’s bathroom would be categorized as “male” by 100% of participants.

Key words: categories, images words
Contrast: contrasting categories, good vs. bad
Cause-and-effect: the words or images to be sorted 100% belong to one of the labels

Researchers hypothesize that faster response times indicate an implicit bias in favor of the grouping. That is, if a person is able to categorize an image as “good or male” more quickly than he is able to categorize an image as “good or female”, this reveals an implicit sexism in favor of males.

Cause-and-effect: someone’s implicit biases will make them react faster when they think the two words go together (e.g. if they are biased against females, they will react faster when “female or bad” are grouped).

The implicit assumption test was made available on the website of a prominent university and after several news stories, became very popular, with over 150,000 participants in the span of just a few months. The data showed the following results:

Cause-and-effect: media coverage made the test really popular
Table 1a and 1b The average delay (in milliseconds) that a person took to correctly categorize an image.

<table>
<thead>
<tr>
<th></th>
<th>Good</th>
<th>Bad</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slim</td>
<td>751 ms</td>
<td>1003 ms</td>
</tr>
<tr>
<td>Fat</td>
<td>1150 ms</td>
<td>633 ms</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Good</th>
<th>Bad</th>
</tr>
</thead>
<tbody>
<tr>
<td>Able</td>
<td>833 ms</td>
<td>998 ms</td>
</tr>
<tr>
<td>Disabled</td>
<td>1012 ms</td>
<td>710 ms</td>
</tr>
</tbody>
</table>

Tables 1a and 1b show us that the average response time was faster for “fat and bad” than it was for “fat and good” and that the average response time was faster for “disabled and bad” than it was for “disabled and good”, revealing the implicit associations in the participant pool.

1. Which of the following correctly identifies a limitation of the data set used?

A) The size of the data set prevents the conclusions from having significant statistical power.
B) Because the test works on implicit associations, it is unable to provide insight about those who are consciously biased.
C) Recruitment through media discussion of the test, without the usual small payment to participants, means the data set would skew towards much higher ends of the socioeconomic ladder.

D) The self-selection of participants prevents the data from being generalizable to any particular population.

The study had a huge pool of self-selected participants. Because the researchers could not control for (or always know) the demographic data of the participants, it limits their ability to generalize the data to any particular subset or population.

A: The sample size was huge, making choice A the opposite of what happened.
B: While the test is not one of explicit biases, that is not a limitation in the study. A study of implicit biases is not obliged to also be a test of explicit biases.
C: We have no reason to think that participants were necessarily unusually high on the socioeconomic ladder.

2. The procedure described in the passage should also include each of the following EXCEPT:

A) One or more training rounds in which the person only needs to categorize an image as “good” vs. “bad”, rather than having to be aware of two distinct categorizations at once.
B) Controls in which the two categories have no meaningful connection (implicit or otherwise), such as “up or red” vs. “down or green”.

© 2015 Next-Step Pre-Med, LLC. All rights reserved. Do not distribute this document in any form.
C) **Recruitment procedures to guarantee that equal numbers of male and female participants are gathered.**

D) Subsequent data analysis that discards outlying data points as irrelevant (e.g. a latency of 150,000 ms that suggests the person got up and left the computer in the middle of the test).

Choices A, B, and D all describe standard procedures that would be a part of a good study protocol. Since the test hinges on very fast reactions (measuring in milliseconds), participants must be trained on the basics of selecting left and right (choice A). In addition, good controls would allow researchers to ensure that any biases are not simply due to lateralization of the categories (choice B), and any outlier data points that don’t demonstrate meaningful participant in the experiment should also be discarded (choice D).

A research protocol is not obliged to study exactly equal numbers of males and females (after all, it’d be hard to image a prostate cancer study involving any females!).

3. The results from the experiment indicate that:

A) no implicit associations are associated with able-bodied versus disabled people.  
B) study participants demonstrated a stronger implicit preference for slimness than against able bodied people.  
C) a self-selected participant pool is more likely to have implicit biases than the general population.  
D) **study participants demonstrated a stronger implicit preference against fat people than against disabled people.**

The two tables show us that the participants had strong implicit biases against fat and disability. Looking at the numbers, we see that people responded faster to the “fat and bad” grouping than they did to the “disabled and bad” grouping. They also responded slower to “fat and good” than they did “disabled and good”. Taken together, this data suggests a stronger negative implicit bias against fat than against disability.

4. If study participants feel a mild sensation of disgust in response to a word or image associated with disabled people, the Cannon-Bard theory of emotion would assert that:

A) **the physiological arousal and emotional sensation of disgust arise separately and independently in separated areas of the brain.**  
B) the emotion is the result of the brain assessing the context of the physiological arousal experienced in the body.  
C) the emotion follows from and is directly caused by the physiological arousal experienced.
D) the emotion is a cognitive response which then causes autonomic reflexes generating the feeling of the affect.

The Cannon-Bard theory of emotion posits that the physiological arousal associated with the emotion and the subjective feeling of the emotion itself arise from separate and independent areas of the brain. This most closely matches choice A.

B: This is more like the Schacter-Singer theory.
C: This is the James-Lange theory of emotion.

5. The test is assessing:

A) unconscious discrimination.
B) conscious discrimination.
C) **unconscious prejudice**.
D) conscious stereotypes.

Because the test is one of implicit biases, we can eliminate choices B and D right off the bat. Discrimination is a behavior, not an attitude or idea, making choice A wrong as well. By process of elimination, we’re left with choice C.
28. In the classic series of children’s books, “Where’s Waldo?” the child is presented with a huge, colorful image filled with characters and objects, and must search through the image looking for a particular character wearing a red and white striped shirt. This exercise represents what sort of sensory processing set up?

A) Unimodal stimuli and top-down processing  
B) Unimodal stimuli and bottom-up processing  
C) Multimodal stimuli and top-down processing  
D) Multimodal stimuli and bottom-up processing

In a “Where’s Waldo” book the stimuli are all visual, meaning the stimulus is a single mode. This lets us eliminate choices C and D. Since the child is taking in the visual image and processing it at a higher level, interpreting the information and seeking out a particular character, this would be top-down processing of sensory information. Thus choice A is correct.
Risk attitudes are generally assessed under one of two frameworks: behavioral neuroscientists who assess personality traits of harm avoidance and novelty seeking, and behavioral economists who measure financial risk-taking decisions. In a study designed to evaluate these two frameworks, a group of 23 participants were given four different assessments. The following correlation matrix was developed:

<table>
<thead>
<tr>
<th>Novelty-Seeking</th>
<th>Harm Avoidance</th>
<th>Extraversion</th>
<th>Economic Risk-Taking</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Novelty-Seeking</strong></td>
<td>-0.65</td>
<td>-0.33</td>
<td>+0.02</td>
</tr>
<tr>
<td><strong>Harm Avoidance</strong></td>
<td>1</td>
<td>-0.27</td>
<td>+0.05</td>
</tr>
<tr>
<td><strong>Extraversion</strong></td>
<td>-0.33</td>
<td>1</td>
<td>-0.11</td>
</tr>
<tr>
<td><strong>Economic Risk-Taking</strong></td>
<td>+0.02</td>
<td>+0.05</td>
<td>1</td>
</tr>
</tbody>
</table>

**Table 1** Correlation matrix between three different temperament categories and one assessment of economic behavior.

Higher dopaminergic activity is associated with increased novelty-seeking and risk-taking behaviors. This led researchers to investigate a particular gene for a dopamine receptor. Early studies suggested that a particular gene variant, the 7R allele, was correlated with increased risk-taking. However, a meta-study encompassing nearly 4,000 subjects found no significant correlation between variations in the dopamine receptor and either novelty-seeking or risk-taking behavior.

Given the lack of compelling results with the gene for this dopamine receptor, many researchers turned their attention to serotonergic activity. The SLC6A4 gene is involved in regulation of serotonin. One allele variant in this gene is a shorter version of the promoter region for the gene. This shorter promoter region results in decreased transcriptional efficiency. In a study, researchers found that those who were homozygous carriers of this shortened allele variant took 28% less risk in an economic exercise with real-money payouts. Such homozygous individuals were also more likely to demonstrate neuroticism and harm avoidance.

1. The data in table 1 suggest that if a psychiatrist is treating a patient who has made a number of very risky financial investments in life, the result of which leaves the patient in dire financial straits, the psychiatrist will also likely find that:

A) the patient will score very high on assessments of novelty-seeking.
B) there will be a positive correlation with assessments of extraversion.
C) the patient may exhibit high or low scores in temperament inventories assessing novelty-seeking and extraversion.

© 2015 Next-Step Pre-Med, LLC. All rights reserved. Do not distribute this document in any form.
D) there is at least a somewhat elevated chance that the person does have the shorter promoter region in his SLC6A4 gene.

2. In the first study described in the passage:

A) there is a methodological flaw in comparing three temperament measures but only one behavioral economic measure.
B) the statistical power of the study is significantly limited by the small number of study participants.
C) demonstrates that there are different genetic bases of risk-taking behaviors in different life domains.
D) is flawed because it failed to find the accepted strong positive correlation between novelty-seeking and harm avoidance.

3. Disorders related to the 7R allele that had been thought to be associated with increased risk-taking behavior could theoretically be associated with any of the following disorders EXCEPT:

A) schizophrenia.
B) Parkinson's disease.
C) Korsakoff's syndrome.
D) bipolar disorder.

4. A person who is homozygous for the shortened SLC6A4 promoter region gene variant would likely display which of the following temperaments?

A) Higher than average novelty-seeking
B) Slightly increased extraversion but lower than average novelty seeking
C) Both decreased harm avoidance and decreased extraversion
D) Novelty-seeking behaviors that could be higher or lower than average

5. The early studies that found a correlation between a particular dopamine receptor variant which was later disproven by the large meta-study could have made any of the following errors EXCEPT:

A) an excess of effort placed on correctly establishing external validity.
B) systematic error that incorrectly flagged participants as having a particular gene variant when they did not.
C) a sample size that was too small to generate meaningful data.
D) a methodological bias that failed to adequately screen for confounders.
Passage 1 Explanation

**Risk attitudes** are generally assessed under one of two frameworks: behavioral neuroscientists who assess personality traits of harm avoidance and novelty seeking, and behavioral economists who measure financial risk-taking decisions. In a study designed to evaluate these two frameworks, a group of 23 participants were given four different assessments. The following correlation matrix was developed:

**Key words: risk attitude, neuroscientists, economists**

**Contrast: Risk as personality trait vs. financial decisions**

<table>
<thead>
<tr>
<th></th>
<th>Novelty-Seeking</th>
<th>Harm Avoidance</th>
<th>Extraversion</th>
<th>Economic Risk-Taking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Novelty-Seeking</td>
<td>1</td>
<td>-0.65</td>
<td>-0.33</td>
<td>+0.02</td>
</tr>
<tr>
<td>Harm Avoidance</td>
<td>-0.65</td>
<td>1</td>
<td>-0.27</td>
<td>+0.05</td>
</tr>
<tr>
<td>Extraversion</td>
<td>-0.33</td>
<td>-0.27</td>
<td>1</td>
<td>-0.11</td>
</tr>
<tr>
<td>Economic Risk-Taking</td>
<td>+0.02</td>
<td>+0.05</td>
<td>-0.11</td>
<td>1</td>
</tr>
</tbody>
</table>

**Table 1** Correlation matrix between three different temperament categories and one assessment of economic behavior.

Table 1 shows us that there is a strong negative correlation between novelty-seeking and harm avoidance and a weak negative correlation between novelty-seeking and extraversion, as well as harm avoidance and extraversion. There is no real correlation (positive or negative) between economic risk-taking and the temperaments studied.

Higher dopaminergic activity is associated with increased novelty-seeking and risk-taking behaviors. This led researchers to investigate a particular gene for a dopamine receptor. Early studies suggested that a particular gene variant, the 7R allele, was correlated with increased risk-taking. However, a meta-study encompassing nearly 4,000 subjects found no significant correlation between variations in the dopamine receptor and either novelty-seeking or risk-taking behavior.

**Cause-and-effect: increased dopaminergic activity is associated with novelty-seeking and risk-taking**

Contrast: early on we thought this one dopamine receptor was involved, but a bigger study showed it wasn’t

Given the lack of compelling results with the gene for this dopamine receptor, many researchers turned their attention to serotonergic activity. The SLC6A4 gene is involved in regulation of serotonin. One allele variant in this gene is a shorter
version of the promoter region for the gene. This shorter promoter region results in decreased transcriptional efficiency. In a study, researchers found that those who were homozygous carriers of this shortened allele variant took 28% less risk in an economic exercise with real-money payouts. Such homozygous individuals were also more likely to demonstrate neuroticism and harm avoidance.

Key terms: serotonergic, SLC6A4
Cause-and-effect: homozygous carriers of the short SLC6A4 took less risk, were more harm-avoidant and neurotic

1. The data in table 1 suggest that if a psychiatrist is treating a patient who has made a number of very risky financial investments in life, the result of which leaves the patient in dire financial straits, the psychiatrist will also likely find that:

A) the patient will score very high on assessments of novelty-seeking.
B) there will be a positive correlation with assessments of extraversion.
C) the patient may exhibit high or low scores in temperament inventories assessing novelty-seeking and extraversion.
D) there is at least a somewhat elevated chance that the person does have the shorter promoter region in his SLC6A4 gene.

The correlation matrix shows us that economic risk-taking behavior is not correlated with any of the other temperaments studied. Thus, choice C is correct and the patient may exhibit high or low scores.

D: The short promoter region is associated with less risk, not more.

2. In the first study described in the passage:

A) there is a methodological flaw in comparing three temperament measures but only one behavioral economic measure.
B) the statistical power of the study is significantly limited by the small number of study participants.
C) demonstrates that there are different genetic bases of risk-taking behaviors in different life domains.
D) is flawed because it failed to find the accepted strong positive correlation between novelty-seeking and harm avoidance.

The first study presented only tested 23 participants. The smaller the pool of people studied, the less statistical power the data has. Thus choice B is correct.

A: This is not a flaw, as one could certainly design a research protocol to look for a correlation between three different factors and one kind of behavior.
C: The study only presents some weak correlations and gets nowhere near making a causal claim about the genetic bases of different kinds of risk behavior.
D: This is false as there is not an accepted positive correlation between novelty-seeking and harm avoidance.

3. Disorders related to the 7R allele that had been thought to be associated with increased risk-taking behavior could theoretically be associated with any of the following disorders EXCEPT:

A) schizophrenia.
B) Parkinson's disease.
C) Korsakoff's syndrome.
D) bipolar disorder.

The 7R allele discussed related to the brain's dopaminergic systems. Choice A, B, and D are all diseases associated with disorders of dopaminergic activity. The right answer, choice C is due to a thiamine (vitamin B₁) deficiency in the brain.

4. A person who is homozygous for the shortened SLC6A4 promoter region gene variant would likely display which of the following temperaments?

A) Higher than average novelty-seeking
B) Slightly increased extraversion but lower than average novelty seeking
C) Both decreased harm avoidance and decreased extraversion
D) Novelty-seeking behaviors that could be higher or lower than average

The passage tells us that individuals who are homozygous for the shortened SLC6A4 promoter region score higher in harm avoidance. We see from the correlation matrix that harm avoidance is negatively correlated with novelty-seeking. It's also (weakly) negatively correlated with extraversion, making choice B's "slightly increased" less likely, but choice B is still the best option.

A, D: Novelty-seeking is very unlikely to be higher than average given that harm avoidance and novelty-seeking are strongly negatively correlated.
C: The passage tells us that this gene variant is associated with harm-avoidance, so this answer choice contradicts the passage.

5. The early studies that found a correlation between a particular dopamine receptor variant which was later disproven by the large meta-study could have made any of the following errors EXCEPT:

A) an excess of effort placed on correctly establishing external validity.
B) systematic error that incorrectly flagged participants as having a particular gene variant when they did not.
C) a sample size that was too small to generate meaningful data.
D) a methodological bias that failed to adequately screen for confounders.
Choices B, C, and D all describe classic flaws that can be encountered when constructing an experiment. Biases, confounders, systematic errors, and too-small sample sizes all reduce the validity of an experiment. Choice A, the correct answer, is not a problem – external validity is a good thing and effort to establish it would only make an experiment more sound.
45. An immigrant family finds economic success and moves to a wealthy neighborhood in a new state. In this state, the population of people from the immigrant family’s home country is much lower than the national average, and there are no other immigrant families in the wealthy neighborhood. As a consequence of this move, the family may likely experience:

A) low socioeconomic status.
B) an absence of social capital.
C) social exclusion.
D) environmental injustice.

Social exclusion may result from this immigrant family moving to a neighborhood where they stand out as the only family that is different from their neighbors.

A: The question tells us that the family has found economic success, allowing them to move to a wealthy neighborhood. So they do not have a low socioeconomic status.
B: While they may have lower social capital than other well-established members of the community, we’ve no reason to suspect that this family doesn’t have some social connections (through other immigrant families in their old state, etc.) to provide social capital.
D: Environmental injustice is typically suffered by those of low socioeconomic status (e.g. having a toxic waste dump placed near a poor neighborhood), rather than by those in the wealthy neighborhood described in the question.
Insert at Page 218 – New Section 4, Passage 1

A certain freshwater fish species that lives in the Amazon river and its tributaries demonstrates three different mating strategies by the males. Reproduction begins with the females selecting a small, safe area under an overhang. Males then compete for permission to enter the female’s selected nesting site. The females are significantly larger than the males and can easily injure or kill a male that has not been given permission to enter the nest. Once a male has entered the nest, the female lays the eggs, after which the male will fertilize them.

Males will adopt one of three strategies when attempting to mate: conflict, avoidance, or stealth. Males that elect conflict will engage in direct combat with other males, often inflicting and receiving injuries. The victorious male will mate with the female after the competitor has been driven off. Males that elect avoidance will simply patrol the area looking for available females, and will back down immediately when confronted by another male. Thus they avoid conflict, but also lose out on potential mating opportunities. Finally, males that elect stealth will attempt to enter the nesting site without being detected by other males or even the female. Interestingly, the females’ mating behavior does not vary once the male is in the nest. They will lay their eggs upon finding a male in the nest, whether the male was given permission to enter or simply entered by stealth.

Table 1

<table>
<thead>
<tr>
<th></th>
<th>Conflict</th>
<th>Avoidance</th>
<th>Stealth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conflict</td>
<td>1/2 - I</td>
<td>0</td>
<td>1/3</td>
</tr>
<tr>
<td>Avoidance</td>
<td>1</td>
<td>0</td>
<td>2/3</td>
</tr>
<tr>
<td>Stealth</td>
<td>2/3</td>
<td>1/3</td>
<td>1/2</td>
</tr>
</tbody>
</table>

The success of a given strategy depends on the types of strategies adopted by the other males and the encounters between them. Early in the season, sneaking fish will tend to be much more successful as their strategies allow them to move quickly from nest to nest looking for potential mates. The table demonstrates the results of encounters between males of different strategies, with the payoff given as the average result of the encounter over the course of the mating season.

1. Based on the description in the passage, the most successful reproduction strategy is likely to be:
   A) stealth.
   B) avoidance.
   C) conflict, so long as the value for I is less than 2/3.
   D) indeterminate, as successful mating will depend on additional factors.
2. In a sub-species of the fish, males have also demonstrated a fourth strategy involving conflict unless the other male begins fighting back vigorously. The male will quickly back down and mimic the behavior of a defeated male but then attempt to use stealth to enter the nest. The advantage of this strategy is that it provides which of the following?
A) Flexibility to change behavior in response to the strategies adopted by the majority of other fish
B) The ability to avoid any injures due to confrontation
C) An overall higher level of reproductive success
D) A meta-stable strategy that will be present in any equilibrium

3. In addition to the behaviors described in the passage, a small percentage of males are born physiologically fertile but behaviorally sterile. They will not even attempt to reproduce, but will instead defend nests from a certain common predator species. These fish:
A) are demonstrating intra-specific commensalism with the females whose nests they defend.
B) have an allele that must decrease over time due to their lack of reproduction.
C) are behaving altruistically, increasing the inclusive fitness of their local population.
D) must have some sort of neurological damage to their central nervous system that causes them to misinterpret the females as not being potential mates.

4. Some evidence suggests that these strategies are genetically determined but may also be shaped by operant learning. Which of the following would most strengthen the theory that the males’ strategy choice is a result of operant conditioning rather than purely genetic?
A) Those males that grow to be larger than average will almost always adopt a conflict strategy.
B) Males taking an avoidance strategy will often flee from other objects that are not even fish, if those objects have certain features (coloration, patterns, etc) that look like other male fish of the species.
C) Males who adopt a stealth strategy may sire offspring who will adopt either the stealth or the avoidance strategy, not exclusively the stealth strategy.
D) Males will typically adopt a conflict strategy and, after being injured, switch to a stealth strategy and will only switch to avoidance upon several unsuccessful attempts at stealth.

5. Upon entering the nest, males induce females to lay eggs by flashing a patch of bright orange scales on their ventral side. These scales weigh the male fish down and make movement metabolically expensive. Yet there is a strong correlation between the mass of these scales and male fitness. This feature is likely a result of:
A) divergent selection.
B) stabilizing selection.
C) sexual selection.
D) allopatric speciation.
Passage 1 Explanation

A certain freshwater fish species that lives in the Amazon river and its tributaries demonstrates three different mating strategies by the males. Reproduction begins with the females selecting a small, safe area under an overhang. Males then compete for permission to enter the female's selected nesting site. The females are significantly larger than the males and can easily injure or kill a male that has not been given permission to enter the nest. Once a male has entered the nest, the female lays the eggs, after which the male will fertilize them.

Key terms: different mating strategies
Cause-and-effect: the females’ larger size means she can kill any male that attempts to enter the nest without permission

Males will adopt one of three strategies when attempting to mate: conflict, avoidance, or stealth. Males that elect conflict will engage in direct combat with other males, often inflicting and receiving injuries. The victorious male will mate with the female after the competitor has been driven off. Males that elect avoidance will simply patrol the area looking for available females, and will back down immediately when confronted by another male. Thus they avoid conflict, but also lose out on potential mating opportunities. Finally, males that elect stealth will attempt to enter the nesting site without being detected by other males or even the female. Interestingly, the females’ mating behavior does not vary once the male is in the nest. They will lay their eggs upon finding a male in the nest, whether the male was given permission to enter or simply entered by stealth.

Key terms: conflict, avoidance, stealth
Contrast: the variations in the various mating strategies

Table 1 Encounters between male fish 1 (top row) and male fish 2 (left column) and the payoff for fish 1 as a result of the encounter. Payoff of successful mating = 1 and I = injury chance.

<table>
<thead>
<tr>
<th></th>
<th>Conflict</th>
<th>Avoidance</th>
<th>Stealth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conflict</td>
<td>1/2 - I</td>
<td>0</td>
<td>1/3</td>
</tr>
<tr>
<td>Avoidance</td>
<td>1</td>
<td>0</td>
<td>2/3</td>
</tr>
<tr>
<td>Stealth</td>
<td>2/3</td>
<td>1/3</td>
<td>1/2</td>
</tr>
</tbody>
</table>

Table 1 shows us that during an encounter between two males, the conflict strategy trumps avoidance, that conflict v. conflict brings a cost of potential injury, and that stealth is more successful sneaking by an avoidance male rather than a conflict male.

The success of a given strategy depends on the types of strategies adopted by the other males and the encounters between them. Early in the season, sneaking fish will tend to be much more successful as their strategies allow them to move quickly.
from nest to nest looking for potential mates. The table demonstrates the results of encounters between males of different strategies, with the payoff given as the average result of the encounter over the course of the mating season.

**Key term: success, season**

*Cause-and-effect: whether a strategy is successful depends on the strategies being adopted by other males, and on other factors such as time of year (how far into mating season it is)*

1. Based on the description in the passage, the most successful reproduction strategy is likely to be:
   A) stealth.
   B) avoidance.
   C) conflict, so long as the value for I is less than 2/3.
   D) indeterminate, as successful mating will depend on additional factors.

   The passage tells us that the success of a strategy is not determined simply by the outcome of an individual male-male conflict, but rather by different factors, including the strategies of the other males in the area and the time of year.

2. In a sub-species of the fish, males have also demonstrated a fourth strategy involving conflict unless the other male begins fighting back vigorously. The male will quickly back down and mimic the behavior of a defeated male but then attempt to use stealth to enter the nest. The advantage of this strategy is that it provides which of the following?
   A) Flexibility to change behavior in response to the strategies adopted by the majority of other fish
   B) The ability to avoid any injuries due to confrontation
   C) An overall higher level of reproductive success
   D) A meta-stable strategy that will be present in any equilibrium

   Given that the passage tells us that success depends on the strategies being adopted by the other males, an ability to adjust one’s strategy in response to that factor is likely to be a significant advantage.

   B: This new strategy may not help avoid “any” injury, since the fish will only back down *after* the other male has started fighting vigorously.
   C: We’re told nothing about overall level of success among fish who adopt this strategy. There may be some deleterious side-effect for these fish.
   D: The word “any” is too strong as we can’t know if this strategy would be present in any equilibrium.

3. In addition to the behaviors described in the passage, a small percentage of males are born physiologically fertile but behaviorally sterile. They will not even attempt to reproduce, but will instead defend nests from a certain common predator species. These fish:
A) are demonstrating intra-specific commensalism with the females whose nests they defend.
B) have an allele that must decrease over time due to their lack of reproduction.
C) are behaving altruistically, increasing the inclusive fitness of their local population.
D) must have some sort of neurological damage to their central nervous system that causes them to misinterpret the females as not being potential mates.

Altruism is behavior that benefits another at a cost to oneself. Here, the male fish is giving up the opportunity to mate even though it is physiologically capable of doing so. It then places itself in danger by defending the nest from predators. This altruistic behavior increases the overall fitness of the local population of these fish, thus increasing inclusive fitness.

A: Commensalism is a benefit to one organism and neither a benefit nor a harm to another.
B: The allele doesn't have to decrease over time, as there may be some advantage conferred by it though kin selection, creating a stable frequency in the population.
D: Nothing in the question or passage suggests that these fish have neurological damage.

4. Some evidence suggests that these strategies are genetically determined but may also be shaped by operant learning. Which of the following would most strengthen the theory that the males' strategy choice is a result of operant conditioning rather than purely genetic?
A) Those males that grow to be larger than average will almost always adopt a conflict strategy.
B) Males taking an avoidance strategy will often flee from other objects that are not even fish, if those objects have certain features (coloration, patterns, etc) that look like other male fish of the species.
C) Males who adopt a stealth strategy may sire offspring who will adopt either the stealth or the avoidance strategy, not exclusively the stealth strategy.
D) Males will typically adopt a conflict strategy and, after being injured, switch to a stealth strategy and will only switch to avoidance upon several unsuccessful attempts at stealth.

Operant conditioning is a form of learning in which the individual learns based on the outcomes or responses to behaviors. Here, only choice D describes the individual observing the response to his behaviors and then adjusting. For example, being injured for taking a conflict strategy is a classic operant positive punishment that will decrease the conflict behavior.

5. Upon entering the nest, males induce females to lay eggs by flashing a patch of bright orange scales on their ventral side. These scales weigh the male fish down and make movement metabolically expensive. Yet there is a strong correlation between the mass of these scales and male fitness. This feature is likely a result of:
A) divergent selection.
B) stabilizing selection.
C) **sexual selection.**
D) allopatric speciation.

Sexual selection is a form of directional selection pressure in which certain phenotypic features are preferentially selected for during the mating process even if such features (e.g. a peacock's feathers) have no direct correlation with fitness. Here, the bright orange scales are like a peacock's feathers.
46. A student spending a semester abroad in Japan decides to spend a week's vacation visiting China. While wandering around the streets of Beijing's outskirts he sees a Chinese grandmother encouraging her four year old son to take his pants down and defecate off the sidewalk onto the street. The student reacts with an overwhelming sense of shock and disgust. This reaction is an example of:

A) ethnocentrism.
B) material culture.
C) operant conditioning.
D) culture shock.

Culture shock is the feeling of discomfort or unpleasantness one has upon encountering cultural norms that are different from one's own. In this case, the student encountered a very different cultural norm about bathroom behavior and felt an instance of culture shock.

A: We're told that the student felt a sense of disgust about a particular behavior, not that he felt his entire culture was superior to Chinese culture.
B: Behaviors regarding body modesty aren't inherently a part of the material aspects of culture.
C: While the student may have originally learned toilet training through some form of operant conditioning, that does not explain his current reaction.