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The Effects of Pre-exposure and Stimulus Intensity on Epistemic Curiosity

Katie Varey

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The goal of the current study was to investigate the role of the human curiosity drive. More specifically, the effects of pre-exposure and stimulus intensity on epistemic curiosity and the effects this has on performance. Forty participants were given statement sheets containing the answers to a questionnaire that they subsequently filled out. Pre-exposure was manipulated by giving some questions before and after the statement sheet while stimulus intensity was manipulated by using coloured font for various answers on the statement sheet. The other two groups had both of these variables or neither. A 2x2 ANOVA was used and pre-exposure was found to have a significant main effect on performance (F (1,36 = 1.47, p > .05).

The observation and attainment of the stimuli in our environments leads to symbolic representation in which we call knowledge (Berlyne, 1954b). Humans have a quest for knowledge, however, little is known about the motivation underlying this quest (Berlyne, 1954b & Kang et al, 2009). It is known that humans spend sufficient parts of their lives engaging in behaviours of which have an underlying drive. Various drives such as hunger, thirst and sex are known to be essential to human survival and whose dissatisfaction can cause huge amounts of distress. Yet, many of the wonders that inspire the most persistence in the search for answers lead to distress when these answers are not reached and are not of urgent need or value. Since the beginning, humans have devoted much time and effort to attending to new and strange stimuli and strive to gain answers about their environments. This tells us that the acquisition of knowledge is more than beneficial; it is needed for human existence. This type of motivation, according to the
modern learning theory, leads us to a drive that is reduced by the reception and rehearsal
of knowledge called curiosity (Berlyne, 1954b). It is known as perceptual curiosity in
animals and can be present in many types such as cats, monkeys and rats, however, for
the purpose of this report epistemic curiosity will be acknowledged as it is the human
curiosity drive. Epistemic curiosity is a high drive state that motivates the quest for
knowledge and is relieved by the acquisition of knowledge (Berlyne, 1962). It arises
from a discrepancy between what one knows and what one wants to know (Kang et al,
2009). As stated in Berlyne’s theory of curiosity (Berlyne, 1954a), this type of human curiosity is aroused by what is called
thematic probes. In the current study these are questions and have been found in previous
studies to be the most salient examples of thematic probes (Berlyne, 1954a). These
include mostly specific interrogation questions which are distinct from those which can
be answered in yes or no format. These thematic probes evoke drive-producing meaning
responses (curiosity). This increase of curiosity drive strength is due to the intensity of
the drive-stimulus which produces the drive-producing meaning responses and the degree
of conflict between the meaning responses (Berlyne, 1954a). The intensity of the drive-
stimulus will depend on the prolongation and the strength of curiosity. According to Hull
(1943), these aspects depend on reaction-potential ($sE_R$) which is largely a function of
habit-strength ($sH_R$), reactive inhibition ($I_R$) and drive ($D$). In Hull’s Theory, reaction
potential ($sE_R$) has a learning component because of the $s$ and $R$ subscripts and leads
directly to behaviour. Habit-strength ($H_R$) is also related to behaviour and is assumed to equal reaction-potential. During previous experiments by Berlyne (1954a), habit-strength was a function of reinforcements such as the number of times that arousal of curiosity by similar questions in the past led to a successful quest for an answer. In the current study, the reinforcements are based on the fact that answers are given to questions after curiosity is aroused. Habit-strength is the number of times that arousal of curiosity leads to learning through similar questions and intensified answers in the past. Reactive inhibition ($I_R$) is that behaviour which is done over and over again which, ultimately, slows down the behaviour. In the same previous experiments by Berlyne, (1954a) reactive inhibition depended on the amount of effort put forth to find the answers to similar questions in the past and the number of time this pursuit led to failure. In the previous study, reactive inhibition depended on the same effort exerted to answer the questions of which they had been exposed to and whose answers that had been intensified in colour previously, and the number of times this quest led to failure as well. As previously mentioned when humans have a high arousal of curiosity it can only be satisfied by being reduced through the reception and subsequent rehearsal of knowledge. In a previous study by Berlyne, (1954a) and current study this is achieved by arousing the curiosity drive by a question and reducing it by rehearsing its answer (Berlyne, 1954a). This works by giving answers which bring to mind the response the person is seeking. In essence, the answers should be rehearsed internally which should be followed by the reduction of the drive. This reduction acts as reinforcement and thus, rehearsal causes a reduction of the drive which in turn reinforces learning. Consequently, the pursuit to find answers has been rewarded with the learning of a new piece of knowledge.
Until now Berlyne's theory has explained arousal of curiosity through unobservable central processes. However, Kang et al. (2009) has looked at functional magnetic resonance imaging (fMRI) and discovered observable brain activity in inferior frontal and medial frontal gyrus, parahippocampal gyrus, premotor cortex, cerebellum and caudate regions that correlates with the level of curiosity when reading trivia questions. In another experiment by Kang et al., (2009), higher curiosity in an initial session was correlated with better recall of surprising answers a few weeks later. This study along with fMRI's also showed that curiosity increased activity in memory areas when subjects guessed incorrectly, which suggests that curiosity may enhance memory for surprising new information.

The current study is consistent with Berlyne’s theory of curiosity, thus, it is hypothesized that pre-exposure and stimulus intensity should evoke a heightened arousal of curiosity during the introduction of information, in addition, to a re-arousal of curiosity in the post-statement questionnaire. This information should be internally rehearsed in the statement sheets. Thus, rehearsal of the answers should cause a reduction in the curiosity drive which should serve to reinforce learning when answering the post-statement questionnaire. The current study reveals the role of curiosity in learning by measuring curiosity through recall and, ultimately, performance. Thus being said, on a performance basis, it was hypothesized that participants that were exposed to just pre-exposure or high stimulus intensity would have more correct answers then those with neither condition. In addition, the group that had pre-exposure with high stimulus intensity should have slightly more correct answers then all of the groups because they
had two variables to assist them in their arousal of curiosity which in turn should have played a role in their learning the answers.

Method

Participants

A total of 40 people participated in this study. The participants included approximately 17 people who currently attend Huron University College, 19 people of whom are not currently attending an educational facility but have in the past and 6 people who have not taken any post-secondary education. The participants ranged from 20-65 years of age and were mostly Caucasian. Sex was not assessed so therefore not controlled. There were 28 female and 12 males tested in this study.

Materials

Participant’s completed the tasks using writing utensils such as pens and pencils. The participants were each given a letter of information informing each participant of the purpose of the study and information related to their participation such as confidentiality, risks, benefits and contact information. Afterwards the consent forms were signed upon reading. Subsequently, one of four booklets containing the content of the study were handed out (see Appendix A for complete booklet details). Instructions to complete the tasks were included on the top page of each task. The content of the first task were different for all four groups; one group received a 10 item pre-questionnaire and a 25 item black and white statement sheet, another group received a 25 item coloured statement sheet, another group received a 10 item pre-questionnaire and the 25 item coloured statement sheet and the last group received just a 25 item black and white
statement sheet. Subsequently, all groups received the same 20 item questionnaire and curiosity scale to complete at the end of the study.

Procedure

The random assigning of the four different booklets was done by numbering groups one through four on small pieces of paper and picking them out of a hat 40 times. Once a group number had been picked 10 times it was taken out of the hat to ensure that there would be 10 people in each of the four groups. This allocated the order in which people were randomly assigned to a group once data collection began. After the letter of confirmation was read and the consent form signed, participants were given their booklet. The first booklet was the pre-exposure booklet. At the top of the first page contained the instructions to read carefully the following questions and circle the answer you think most fits the question. Furthermore, the rest of the page contained 10 questions about animals of which could be answered in a multiple choice format with two alternative answers given. For example, a question was, "What type of animals are the macaques? a) Monkeys that can swim under water or b) Birds that are found in rainforests of South America". Once participants completed this questionnaire they were instructed to flip over the page to a statement sheet that just read in black and white font. The top of the first page contained instructions that each statement be read carefully. This part of the study included 25 statements about animals, 10 of which were the answers to the questionnaire previously answered. An example of a statement on this sheet was "The macaques are a type of monkey that has adopted a rare amphibious lifestyle for a primate. They can spend up to 30 seconds under water". When finished the participant was instructed to move on and answer the second questionnaire. The second questionnaire,
which was the same for all four groups, contained 20 open ended questions about animals. Ten of which were the same questions asked in the first questionnaire. For example, the same question that was given in the first questionnaire, “What type of animals are the macaques?” Previously viewing the statement sheet allowed the participants to not only view the previous answers of the questions in the first questionnaire, but as well, answers to the other following 10 questions given in the second questionnaire.

The stimulus intensity group received the same booklet about animals minus the first questionnaire. They were instructed to, again, read over the statement sheet carefully. This time 10 of the statements were presented in coloured font. For example the statement, “Elephants are a symbol of wisdom in Asian cultures,” was presented in green. Once the participant was finished reading through the statements, that again included all answers to the following questionnaire, they were instructed to move on to answer the questionnaire. The group who received both conditions received another booklet containing both the same first questionnaire as the pre-exposure group and the same coloured statement sheet as the stimulus intensity group. Participants were instructed to answer the questionnaire and read carefully through the 25 statements just as the previous groups. Once they were finished reading through the statement sheet they were instructed to move on to the questionnaire. This group would recognize that 10 of the questions in this questionnaire were the 10 questions on the first questionnaire and the 10 statements that were viewed in colour made up the answers to the other 10 questions in the questionnaire. The last booklet contained no pre-exposure questionnaire and only a statement sheet in regular black and white font. This was the booklet for the group that
received neither condition, however, the same instructions applied to this group. They
had to read over the 25 statements and then proceed to answer the questionnaire. Five
additional statements, in the statement sheets of all four groups, were statements about
animals as well but were not included on either questionnaire. In addition, each booklet
contained a curiosity scale that rated their curiosity level altogether at the end of the
study. The ratings were 1 extremely curious, 2 very curious, 3 somewhat curious, 4 not
at all curious. It should be mentioned that while instructions included to place a “C” in
the left-hand column for those questions and answers known for certain from previous
knowledge, it was not assessed as it was found that participants were too often placing
C’s in the column and getting the answer wrong. Therefore, this original task was
disregarded. All of the participants were instructed when given the booklets that once
they flipped the statement sheet over to the questionnaire they could not turn back, this
allowed them to answer only those questions they could recall.

Results

A factorial analysis of variance (ANOVA) was used with an alpha level of .05 for
all statistical tests (see Appendix B for a complete ANOVA summary table). Figure 1
shows that a main effect of pre-exposure was found to be statistically significant, $F (1,
36) = 9.07, p > 0.05)$. The strength of effect of this condition was $r^2 = 0.25$, thus the
effect of pre-exposure accounted for 25% of the total variance. A main effect of stimulus
intensity was not found to be statistically significant, $F (1, 36) = 1.47, p > 0.05)$. An
interaction effect was also not found to be statistically significant, $F (1, 36) = 0.02, p >
0.05)$. The results supported the hypothesis that the pre-exposure with low stimulus
intensity would have higher performance on the questionnaire, however, did not support
Figure 1. Results from the current study show the mean performance scores on the questionnaire for all groups. This graph shows no interaction effects, however, shows a main effect of pre-exposure collapsed across stimulus intensity.
that stimulus intensity with no pre-exposure or pre-exposure with high stimulus intensity would also have more correct answers on the questionnaire.

Discussion

The results of the study support the hypothesis that the pre-exposure would affect performance, thus, allowing for more correct answers in the second questionnaire. Nonetheless, the study did not support the hypothesis that the stimulus intensity group would perform significantly better as would the group exposed to both conditions. The mean scores of performance on the second questionnaire did go in the direction that was predicted for all groups, however, only the pre-exposure condition was found to be significant. These results are similar to what Berlyne (1954a) found in his study of pre-exposure effects on the arousal of curiosity and how it assists in performance. In this same study it was stated that other influences may be factors like stimulus intensity, however, it was not known how much of an effect this variable would have. In the current study the high stimulus intensity and no pre-exposure group achieved more correct answers than the control group who received neither condition however these results were not higher than the other two groups with pre-exposure and were also not found to be significant as no main effect was found. This could be due to a number of various factors. Coloured font was chosen as the stimulus intensity, however, the fact that people did not have higher scores of performance in this group could be because colour as an intensity manipulator may not have been salient enough. Other intensities may have been more attention grabbing such as size of font and may have allowed for more arousal of curiosity. Another reason people may not have acquired higher arousals of curiosity from the coloured font was for some they may have found the normal sized
coloured font to be too different then what they are used to and may have regarded it as annoying. This could be a factor considering many bright colours were used so reading with low attentive reading may have occurred in these statements.

It should be noted that curiosity is clearly not the single most factor in which can lead to better performance. As it was mentioned earlier, there is research to demonstrate that curiosity enhances memory. In this study it is clear that memory played a role in the recall of past answers although it did not work on its own to allow for better performance. The fact that more answers were recalled in the pre-exposure conditions than the stimulus intensity conditions suggests that pre-exposure leads to higher curiosity arousal and it is this higher arousal of curiosity that enhances memory. Other factors such as intellectual ability, mood and motivation can all contribute to the level of performance on such tasks. Here, it was assumed that everyone had the intellectual ability to complete the tasks put forth. As for motivation, it could be said that because rewards were not given for performance quite possibly motivation may not have been as high. Conversely, epistemic curiosity is defined as a drive state that motivates the quest to seek to knowledge, therefore, finding the right answer reduced the curiosity drive and, in itself, was the reinforcement in this study. Time could also be an issue if people were in a rush or had to be somewhere they may not take the task seriously and, therefore, may have not performed to the best of their abilities. In addition, curiosity may be assumed to be higher in those who are attending an educational facility as the primary focus of education is an active learning environment that assumes people are enthusiastic and interested in the acquisition of knowledge. Thus, it was important to accurately
investigate the human curiosity drive by including diverse populations such as people who are currently not attending school or haven’t attended school.

External factors that could have possibly influenced performance have been discussed; however, the attention will now be turned to curiosity as acknowledged in this study as the major contributing factor. Firstly, it should be noted that the only topic that was presented in all of the tasks was animals. It could be the case and was that not everyone may be interested and want to know more about this subject. There could be numerous situations that occurred in this study that could be reasoning for lower curiosity arousal. This would include people who were not interested at all in animals, people that previously knew a lot about this topic so the answers were expected and curiosity was not aroused, and those who were not interested in animals but because it was new information showed higher curiosity arousal. To directly measure curiosity a scale was included at the end of the study. This was a scale that was made up to compare the curiosity levels of the participants in all four groups. It was found that those that had pre-exposure rated their curiosity levels mostly to be extremely curious and very curious. Those who had stimulus intensity mostly rated their curiosity levels as somewhat curious and those in the no condition group rated most of their curiosity levels to not at all curious. This, although, not assessed statistically allows the assumption that pre-exposure did arouse higher curiosity levels which is consistent with the main effects of pre-exposure found in this study.

There were implications with the procedure itself, as already mentioned the content was only about animals which some people were already not interested in from the beginning. If the content contained questions and statements about many different
topics, this may have addressed a variety of interests from many which could be grounds for more arousal of curiosity. Another implication was that there was no way of indicating what questions or statements aroused more curiosity or surprise than others. For different people this would be a changing factor and in order to measure accurately why and when curiosity was aroused certainty, surprise, familiarity and interest would have to be measured in the future. Another implication in this study was the marking scheme of the questionnaire. The answers included a lot of ambiguity because of how people interpreted the statement sheets and what they took from them. If there were three assertions about certain animals in a statement then that was the ideal answer for the questionnaire. Nonetheless on many occasions the participant only mentioned part of an ideal answer, and it was still marked correct. However, if participants had a blurred idea of the correct answer but didn’t include any of the ideal answers in the statement sheet the answer it was marked wrong. To make things easier an ideal answer sheet that included the wording and information that made up the ideal answers for each question was used. If an answer had at least one of the ideas in the same wording as it was shown in the statement sheet then the participant got the question correct.

In summary, changes in stimulus intensity, content and added measures in what the participants already know and are interested in knowing would make for a better study. Up until now, theories of unobservable central processes, brain regions of which are activated in the arousal of curiosity and variables that influence curiosity have been discovered allowing us to gain more insight into the human curiosity drive and the role it has in learning. Future research is likely to be ongoing as curiosity has played a role in
evolution, and will continue to do so, allowing exploratory behaviour in environments where knowledge may gain us survival advantages.
References Cited

Appendix A

Booklets #1, #2, #3 and #4 (as they appear in order)
Questionnaire-1

Please read over the questions carefully and circle the answer you think most fits the question. When these tasks are completed you may go on to the statement sheet given.

1) Are tigers classified as endangered?
   a) yes  
   b) no

2) What type of animals are the macaques?
   a) monkeys that can swim under water  
   b) birds that is found in rainforests of South America

3) What areas do the walia ibex depend on?
   a) high plain meadows and lower elevation coniferous forests  
   b) swampy, marshlands

4) Which of the following is a specific species of elephant?
   a) African forest elephant  
   b) tundra bush elephant

5) What type of waters does the vampire squid survive in?
   a) shallow, sunlit waters  
   b) dark, cold, deep waters

6) What do polar bears mostly hunt?
   a) seals  
   b) birds

7) What is the life span of a great white shark?
   a) 25 years  
   b) 100 years

8) What does a six-plumed bird do with its feathers?
   a) fluffs them out like a skirt while doing a “hula-dance”  
   b) fluffs out the feathers on its head and bounces up and down making a clicking noise
9) How does the glow worm capture its prey?
   a) by releasing a scent from its tail that contains a chemical that is lethal to small insects
   b) by lowering silk strands from its mouth that once in contact a small insect will not possibly be able to escape its sticky texture

10) During the winter months what is the role of the male penguin?
    a) incubate the egg that the female has laid
    b) return to sea to forage
Statement Sheet

Please read over all of the statement carefully. When these tasks are completed you may go on to the questionnaire.

Great White Sharks are typically found in shallow surface areas of all the major oceans.

The sounds of frogs can be very competing; however, frog’s ears are tuned to hear only the calls of their own kind.

Elephants are a symbol of wisdom in Asian cultures.

After a female penguin has laid an egg the male incubates it until it is ready to hatch while the female sets out to the ocean to forage.

Polar Bears are found in cold climates like the Arctic Circle where they hunt mostly seals when the freezing waters of the Arctic start to melt.

The glow worm catches its prey by releasing silk strands from glands in their mouths that are made of very sticky substances in which insects have no escape once they have made contact.

The continent of Antarctica is the size of the United States and hold 90% of the world’s ice.

Macaques like to feed on berries however they will look for any type of food that has fallen from the forest trees.

The six-plumed bird cleans the forest floor of dead leaves and debris before waltzing around with its feather fluffed out trying to attract a female.

A great white sharks lifespan can last over 100 years.

Tigers are found in many parts of Asia like Bangladesh, Nepal and Mya.

The macaques are a type of monkey that has adopted a rare amphibious lifestyle for a primate. They can spend up to 30 seconds underwater.

The walia ibex can be hunted by animals like leopards, hyenas and Ethiopian wolves.
Vampire Squid are found in deep, cold waters of the ocean where light does not penetrate.

Healthy adult elephants do not have any natural predators.

When polar bears are not in hibernation under the snow for 5 months of the year they spend most of their time at sea hunting for food.

Penguins are stereotypically cold climate animals, however, Galapago penguins can be found just north of the equator on Galapago Island and Isabela Island.

The glow worm is found on the walls of caves in New Zealand and Australia.

Elephants are the largest land mammal. There are three species of elephants living today; the Africa forest elephant, African bush elephant and Asian elephant.

A blue whale aorta is large enough to permit a human to walk through it.

At one time there was nine species of tigers, there are now only 6 species left and these remaining six are endangered.

Fossil evidence supports the fact that turtles arrived on earth well before even dinosaurs did.

Glow worm light is nearly 100 percent energy efficient.

Vampire squid get their name because of their black bodies and red eyes, somewhat reminiscent of an actual vampire.

The walia ibex can be found in high plain meadows, in lower elevation coniferous forests and sometimes during the day sunbathing on the rocks.

During courtship the six-plumed bird performs a hula-like dance and spreads its feathers out like a skirt.
Questionnaire-2

Please answer the following questions.

1) What prey do Macaques feed on?

2) In what culture do elephants represent a symbol of wisdom?

3) What areas do the walia ibex depend on?

4) What type of waters does the vampire squid survive in?

5) In what types of waters are great white sharks found roaming?

6) What does a six-plumed bird do with its feathers?

7) The glow worm is found in what habitat?

8) What predators hunt walia ibex?

9) Where do polar bears spend five months of their time?

10) The six-plumed bird does what before trying to attract a mate?

11) What area of the world are tigers found?

12) What type of animals are the macaques?

13) During the winter months what is the role of the male penguin?
14) Are tigers classified as endangered?

15) In what other place other than Antarctica are penguins found?

16) What is the life span of a great white shark?

17) How does the glow worm capture its prey?

18) What does a vampire squid look like?

19) What is a specific species of elephant?

20) What do polar bears mostly hunt?
Questionnaire-1

Please read over the questions carefully and circle the answer you think most fits the question. When these tasks are completed you may go on to the statement sheet given.

1) Are tigers classified as endangered?
   a) yes  b) no

2) What type of animals are the macaques?
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3) What areas do the walia ibex depend on?
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6) What do polar bears mostly hunt?
   a) seals  b) birds

7) What is the life span of a great white shark?
   a) 25 years  b) 100 years

8) What does a six-plumed bird do with its feathers?
   a) fluffs them out like a skirt while doing a "hula-dance"  b) fluffs out the feathers on its head and bounces up and down making a clicking noise
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    a) incubate the egg that the female has laid  
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Statement Sheet

Please read over the statements. When these tasks are completed you may go on to the questionnaire.

Great White Sharks are typically found in shallow surface areas of all the major oceans.

The sounds of frogs can be very competing; however, frog’s ears are tuned to hear only the calls of their own kind.

Elephants are a symbol of wisdom in Asian cultures.

After a female penguin has laid an egg the male incubates it until it is ready to hatch while the female sets out to the ocean to forage.

Polar Bears are found in cold climates like the Arctic Circle where they hunt mostly seals when the freezing waters of the Arctic start to melt.

The glow worm catches its prey by releasing silk strands from glands in their mouths that are made of very sticky substances in which insects have no escape once they have made contact.

The continent of Antarctica is the size of the United States and hold 90% of the world’s ice.

Macques like to feed on berries however they will look for any type of food that has fallen from the forest trees.

The six-plumed bird cleans the forest floor of dead leaves and debris before wallowing around with its feather fluffed out trying to attract a female.

A great white shark’s lifespan can last over 100 years.

Tigers are found in many parts of Asia like Bangladesh, Nepal and Mya.

The macaques are a type of monkey that has adopted a rare amphibious lifestyle for a primate. They can spend up to 30 seconds underwater.

The walia ibex can be hunted by animals like leopards, hyenas and Ethiopian wolves.

Vampire Squid are found in deep, cold waters of the ocean where light does not penetrate.
Healthy adult elephants do not have any natural predators.

When polar bears are not in hibernation under the snow for 8 months of the year they spend most of their time at sea hunting for food.

Penguins are stereotypically cold climate animals; however, Galapagos penguins can be found just north of the equator on Galapagos Island and Isabela Island.

The glow worm is found on the walls of caves in New Zealand and Australia.

Elephants are the largest land mammal. There are three species of elephants living today; the Africa forest elephant, African bush elephant and Asian elephant.

A blue whale aorta is large enough to permit a human to walk through it.

At one time there was nine species of tigers, there are only now 6 species left and these remaining six are endangered.

Glow worm light is nearly 100 percent energy efficient.

Vampire squid get their name because of their black bodies and red eyes, somewhat reminiscent of an actual vampire.

The walia ibex can be found in high plain meadows, in lower elevation coniferous forests and sometimes during the day sunbathing on the rocks.

During courtship the six-plumed bird performs a hula-like dance and spreads it's feathers out like a skirt.
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Please answer the following questions.

1) What prey do Macaques feed on?

2) In what culture do elephants represent a symbol of wisdom?

3) What areas do the walia ibex depend on?

4) What type of waters does the vampire squid survive in?

5) In what types of waters are great white sharks found roaming?

6) What does a six-plumed bird do with its feathers?

7) The glow worm is found in what habitat?

8) What predators hunt walia ibex?

9) Where do polar bears spend five months of their time?

10) The six-plumed bird does what before trying to attract a mate?

11) What area of the world are tigers found?

12) What type of animals are the macaques?

13) During the winter months what is the role of the male penguin?
14) Are tigers classified as endangered?

15) In what other place other than Antarctica are penguins found?

16) What is the life span of a great white shark?

17) How does the glow worm capture its prey?

18) What does a vampire squid look like?

19) What is a specific species of elephant?

20) What do polar bears mostly hunt?
Statement Sheet

Please read over all of the statement carefully. When these tasks are completed you may go on to the questionnaire.

Great White Sharks are typically found in shallow surface areas of all the major oceans.

The sounds of frogs can be very competing; however, frog’s ears are tuned to hear only the calls of their own kind.

Elephants are a symbol of wisdom in Asian cultures.

After a female penguin has laid an egg the male incubates it until it is ready to hatch while the female sets out to the ocean to forage.

Polar Bears are found in cold climates like the Arctic Circle where they hunt mostly seals when the freezing waters of the Arctic start to melt.

The glow worm catches its prey by releasing silk strands from glands in their mouths that are made of very sticky substances in which insects have no escape once they have made contact.

The continent of Antarctica is the size of the United States and hold 90% of the world’s ice.

Macaques like to feed on berries however they will look for any type of food that has fallen from the forest trees.

The six-plumed bird cleans the forest floor of dead leaves and debris before waltzing around with its feather fluffed out trying to attract a female.

A great white sharks lifespan can last over 100 years.

Tigers are found in many parts of Asia like Bangladesh, Nepal and Mya.

The macaques are a type of monkey that has adopted a rare amphibious lifestyle for a primate. They can spend up to 30 seconds underwater.

The walia ibex can be hunted by animals like leopards, hyenas and Ethiopian wolves.
Vampire Squid are found in deep, cold waters of the ocean where light does not penetrate.

Healthy adult elephants do not have any natural predators.

When polar bears are not in hibernation under the snow for 5 months of the year they spend most of their time at sea hunting for food.

Penguins are stereotypically cold climate animals, however, galapago penguins can be found just north of the equator on Galapago Island and Isabela Island.

The glow worm is found on the walls of caves in New Zealand and Australia.

Elephants are the largest land mammal. There are three species of elephants living today; the Africa forest elephant, African bush elephant and Asian elephant.

A blue whale aorta is large enough to permit a human to walk through it.

At one time there was nine species of tigers, there are now only 6 species left and these remaining six are endangered.

Fossil evidence supports the fact that turtles arrived on earth well before even dinosaurs did.

Glow worm light is nearly 100 percent energy efficient.

Vampire squid get their name because of their black bodies and red eyes, somewhat reminiscent of an actual vampire.

The walia ibex can be found in high plain meadows, in lower elevation coniferous forests and sometimes during the day sunbathing on the rocks.

During courtship the six-plumed bird performs a hula-like dance and spreads its feathers out like a skirt.
Please answer the following questions.

1) What prey do Macaques feed on?

2) In what culture do elephants represent a symbol of wisdom?

3) What areas do the walia ibex depend on?

4) What type of waters does the vampire squid survive in?

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18) What does a vampire squid look like?

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Appendix B

ANOVA Summary Table

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Appendix C

Curiosity Scale

Rate how curious you were altogether about the previous information on animals.

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