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Effectiveness of Conservation Education at the Chattanooga Zoo
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Departmental Honors Thesis
University of Tennessee at Chattanooga
Environmental Science

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Abstract

Conservation is the central focus of many modern zoos and aquariums. These zoos incorporate guest education to facilitate a connection between zoo guests and animal conservation. I conducted a study at the Chattanooga Zoo and the University of Tennessee at Chattanooga which examined two modern zoo education approaches. The two approaches utilized in the study are currently used in keeper chats at the Chattanooga Zoo. The first approach is an emotional appeal (an appeal to the personalities of the chimps at the zoo) and the second approach is a utilization of a take-action initiative (recycling cell phones to reduce mining in chimpanzee habitat). Both approaches were placed at the beginning of the same chimpanzee presentation which exclusively involved facts about chimpanzees. These two approaches were tested against a control presentation that involved only the chimpanzee facts and no educational approaches. All three presentations were given to two populations, zoo guests and UTC students in front of the chimpanzee exhibit at the zoo and in various lecture halls at UTC. My goal was to examine the effects of these approaches on retention of chimpanzee related information. I hypothesized that incorporating an emotional appeal in an informational chat increases guest retention more than using a take-action initiative. The response data collected from the Chattanooga Zoo revealed no significant differences in guest retention of information between any of the three zoo chats (presentations) due to small sample size. The results from the UTC student population did yield statistically significant differences. The group exposed to the emotional appeal scored the highest on average, followed by the control group, and finally the take-action initiative group. My study may serve as a starting point for future research involving effectiveness of conservation messaging at the Chattanooga Zoo.

Effectiveness of Conservation Education at the Chattanooga Zoo

The concept of a zoo has changed drastically over time. The earliest notable shift in zoo history is that of the eighteenth to nineteenth century, when zoos transformed from simple symbols of wealth and power to centers of scientific (Figure 1). This shift opened the door to a better understanding of the animals housed in zoos and by extension the necessary requirements of animal husbandry; ultimately leading to a shift from scientific study to the implementation and enforcement of animal welfare standards. The most recent and relevant shift is that of the priority of AZA institutions, which is focused more heavily on conservation (Woodland Park Zoo, 2017).

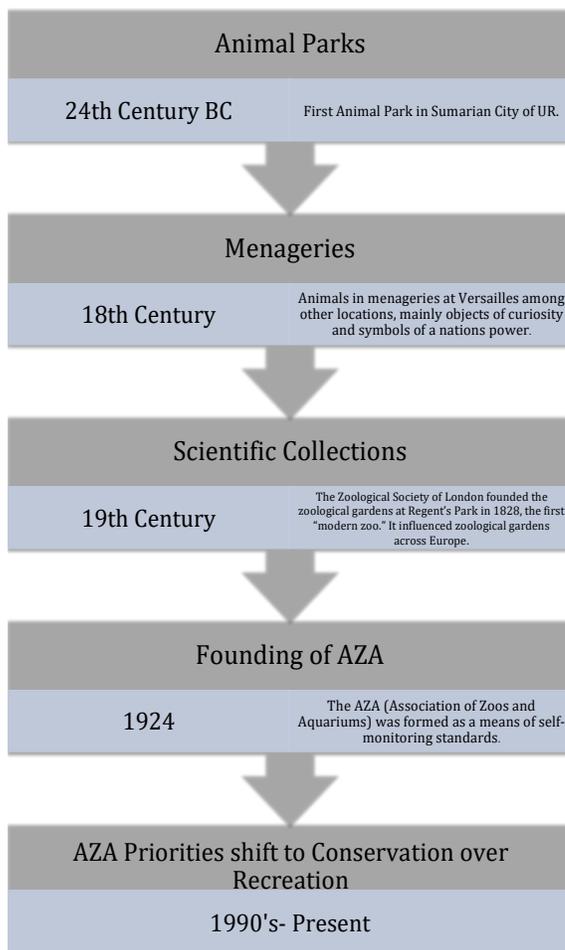


Figure 1. (Adapted from Timeline created by Woodland Park Zoo, see Appendix I)

Isobel Charman (2017) pointed out that Thomas Stamford Raffles, the originator of the London Zoo, believed that zoo animals should be used for scientific study and not for tasteless observation. For the London Zoo this dream and the reality of what it manifested into years later were two very different things. Due to a lack of veterinary, ecological, and behavioral knowledge of zookeepers, many of the animals that were brought to the London Zoo either became very ill and/or died soon after arrival. The structure of the zoo was also almost completely oriented toward the enjoyment of the public, with very little effort originally being put into caring for zoo animals. However, many of the scientific principles held dear to the zoos of the nineteenth century paved the way for zoo-based scientific discoveries of the modern age. The scientific study of zoo animals has brought about a better understanding of small population management, as well as other scientific disciplines ranging from ethology to stress endocrinology (Rabb, 2004).

Modern zoos have become more closely aligned with Raffles vision, developing into institutions of conservation and learning. In fact, the mission statement of the San Diego Zoo, a world renowned institution, emphasizes the zoo's commitment to conservation science and dedication to creating an appreciation for the natural world (San Diego Zoo, 2016). The failed intentions of pioneers such as Thomas Raffles have become a reality through advancements of technology, animal care practices, and the institutional and ethical principles held by zoos (Charman, 2017).

A common misconception is that zoos are prisons for animals. Although zoos may have fit this description in the past, modern zoos, specifically Association of Zoos and Aquariums (AZA) accredited zoos are actually the opposite (Benbow, 2004). AZA Zoos have 13 basic accreditation standards, one of which is directly related to conservation. As it states in the accreditation handbook, conservation efforts are one of the major priorities of AZA zoos and aquariums. There are multiple types of effort put forth by these institutions, contributing to long-term survival of species in their natural habitats, environmental stewardship, and creating educational programs designed to raise conservation awareness and promote pro-conservation behaviors. All of these activities are required to be informed by science. AZA zoos are

institutions of conservation dedicated to raising awareness of the animals housed in their facilities (Association of Zoos & Aquariums, 2017).

AZA zoos have constructed Species Survival Plans (SSPs) for endangered animals housed in their institutions. SSPs are strategies designed to match genetically compatible animals in order to ensure a healthy captive population through breeding, all in the hopes of one day releasing these species back into their natural habitat (Association of Zoos & Aquariums, 2017). The Chattanooga Zoo (the initial study site for this research) actively participates in 28 different SSP programs, from chimpanzees to komodo dragons (Chattanooga Zoo, 2017). While conservation is important to the zoo staff as a practice and goal, it is also important to instill conservation learning in zoo guests through environmental educational programs. Education can help to spread knowledge about conservation work, including SSPs, being done at conservation institutions (MacDonald, Milfont, and Gavin, 2016).

Education is a heavily utilized conservation tool that is often employed by zoos and aquariums (MacDonald, 2016). For example, the San Diego Zoo offers, educational tours, field trips, summer camps, and many more education related activities (San Diego Zoo, 2017). Millions of people attend zoos and aquariums each year. A survey conducted by the World Association of Zoos and Aquariums showed that annually over 700 million people visit zoos and aquariums across the globe and are potentially exposed to environmental education. Individually, members of the public are unlikely to create a meaningful impact in regard to conservation, but collectively the public has the potential to make a substantial positive change (Gusset and Dick, 2010).

A common ignorance among those who visit zoos is that many of the animals they see in AZA zoos are rescues. Many of the zoos around the world are offered animals, both exotic and domestic, by the public as well as governing authorities. These animals often require more care than public pet owners can provide or are confiscations brought in by the authorities (Cuaron, 2005). Zoos are one of the main sources of endangered animals not found in the wild. In their natural habitat, these animals are facing great obstacles such as war, habitat loss, and disease, just to name a few. All of which are problems these animals do not worry about in zoos. This fact is something that most animal activists do not realize. They

want to send these animals back to the wild when the pristine wildlife habitat they are envisioning for these animals either no longer exists or is in limited supply. Thus, zoos have the potential to be a hub for which endangered animals can be safely bred in the hopes of bringing their populations back to sustainable levels (Praded, 2002).

In the past, independent researchers have examined various factors that influence conservation learning for zoo and aquarium guests. One example is a study of the relative credibility of zoo-affiliated spokespeople for delivering conservation messages. The investigators found that there was a hierarchy of credibility. Zoo researchers and biologists were at the top of the hierarchy, while volunteers and zoo executives were at the bottom (Frazer, Johnson, and Sickler, 2008). Another study examined the effectiveness of a specific conservation campaign focused on orangutan habitat loss due to the palm oil industry. Questionnaires were passed out at the entrance and exit of an orangutan exhibit. This exhibit added signage and videos about the harvesting of palm oil as well as the damages that this harvest causes to orangutan habitat. The questionnaires were distributed at the base line, mid-point, and conclusion of the twelve-month campaign. There was a notable increase in overall guest awareness of palm oil. Guests also indicated that they were less likely to purchase items that contained palm oil (Pearson, Lowry, Dorrian, and Litchfield, 2014).

The way zoo guests respond to conservation education can be dependent on many factors, as is described in the work of MacDonald, Milfont, and Gavin (2016). They modified a model created by Petty and Wegener (1996) that was applied to zoo-based presentations and was meant to increase recall of conservation messages by means of understanding and adapting to the factors that influence conservation education. The elaboration likelihood model devised by Petty and Wegener was modified in the study increased the likelihood of potential relevancy (how conservation relates to guests' lives) and elaboration (provoked thinking) in guests that ultimately lead to greater guest satisfaction (see Figure 2). Through the incorporation of this model every party was benefited, the zoo met its goal of having satisfied customers, the guests were satisfied and informed, and the conservation message was effectively spread.

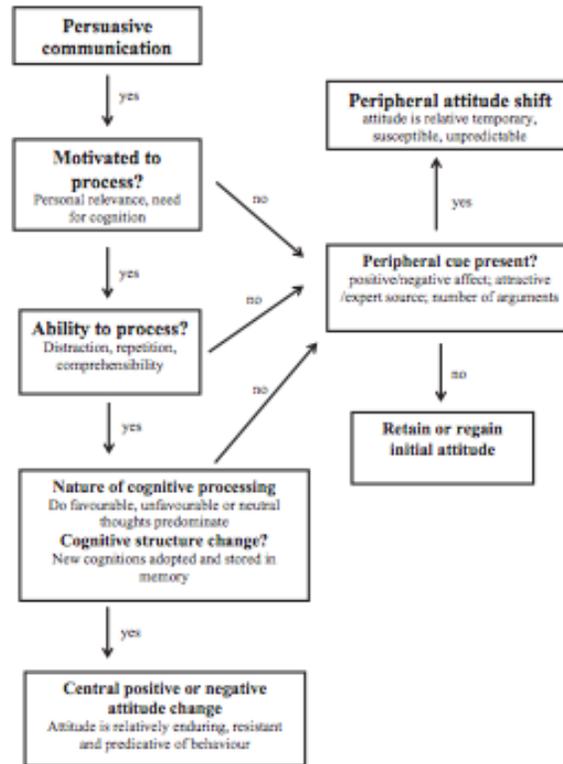


Figure 2. The Elaboration Likelihood Model (ELM) (Petty and Wegener, 1996)

Esson and Moss (2016) conducted a study that emphasized the positive relationship between knowing one's audience and a successful zoo chat. Their research mainly focused on culture on a global scale, in this study the primary investigator looked at how individuals from the local Chattanooga area might react to different approaches of presenting a conservation message. Esson goes into detail about personal meaning mapping (PMMs), which is a universal tool used amongst teachers to gauge what an individual student will take away from any given educational experience. This approach considers different learning styles and abilities and allows many viewpoints to be expressed. In particular where literacy levels are low, PMMs facilitate accessibility. Typically, participants are asked to describe or illustrate what they associate with an anchor statement or word that encapsulates the learning outcomes of the education intervention.

Another study was conducted that considered guests' predisposition toward environmental learning. The researchers found that the consideration of various predispositions, i.e. pre-visit conservation support and enthusiasm to learn tended to be the greatest indicators of the long-term impact of their experience. They concluded that the consideration of guest predisposition could help bring about better exhibit designs and animal experiences that cater to a more diverse audience (Luebke and Matiasek, 2013).

As unguided children move through an exhibit they are less likely to learn from signage alone as compared to a guided tour. Zoo guests, in particular those of a young age, receive and retain much more information if they interact with a live human being as opposed to wandering around an exhibit with no interactions. A study conducted at the London Zoo showed that children who were unguided were less accurate in answering conservation biology questions than before they entered the zoo. This shows the poor job that signage and information placement at that particular zoo was doing in this instance (Jensen, 2014).

Take-action initiatives, in the context of zoos and aquariums, are essentially actions that guests can take to have a positive effect on the environment or wildlife conservation. The primary researchers in the palm oil campaign, discussed earlier, used a video as one of the main tools employed to describe the connection of orangutan habitat loss and palm oil production. The video also listed many of the items that contained palm oil in Australia. This video is a simple yet effective tool for informing zoo guests about an action that they can take to help reduce orangutan habitat destruction, buying products that do not contain palm oil. Over the course of six months, the support for mandatory labeling of products in Australia containing palm oil went from 69.6% to 90%. The study had tremendous results in that guests simply did not know about the dangers of palm oil and, as a result of education, they were able to make a difference in their everyday life through the refusal to use cooking materials containing unsustainable palm oil. This study shows that guests need specific information to feel like they will make a difference (Pearson, Lowry, Dorrian, and Litchfield, 2014).

An emotional appeal is an effective way to get a guests attention, and it is also something that can potentially raise an individual's desire to make a difference in wildlife conservation. The connection that zoo guests feel with a particular zoo animal is measurable and is often a strong indicator of pro-conservation behaviors for said species. Skibins and Powell (2013) examined ways in which guests can have an investment in conservation through methods such as adopting an animal at the zoo. This technique was only effective with limited scope. The guests were only interested in one specific animal and, based on their results, these guests are only influenced by the conservation action that helps that specific animal. Skibins shows how specific the different conservation messages can and have to be in order for certain conservation behaviors to be adopted by guests.

It is important to note the different types of surveys used by zoos. A great variety of surveys have been created in various research efforts employed by zoos and aquariums (Stoinski, Lukas, and Maple, 1998). Entrance and exit surveys can be given in order to test what a guest has learned from a particular exhibit (Pearson, Lowry, Dorrian, and Litchfield, 2014). Certain surveys also enable zoos to gauge the likelihood of potential donations as well as gauge the attitudes of zoo guests in regards to their experience at the zoo (Skibins and Powell, 2013). There are even surveys designed to look at how zoos give out surveys and do research (Stoinski, 1998). Surveying guests allows researchers to gain valuable information regarding what zoo guests have learned, their satisfaction, what is most interesting to them, what they would like to see more of (MacDonald, Milfont, and Gavin, 2014). However, surveys specifically designed to test retention of pertinent information in regards to take-action initiatives as compared to an emotional appeal have not been used.

When surveys are distributed by volunteers the effects can be both positive and negative. On the one hand, volunteers are great resource, on the other they do not have credibility in the eyes of zoo guests. Many zoos use volunteers for their messaging, which ultimately is not as effective as using staff members in regards to credibility. The spokesperson's title is correlated to the credibility the crowd deems worthy for said spokesperson. However, persuasiveness and credibility have yet to be linked in any significant

way so as long as persuasive conservation based arguments are utilized, credibility it seems may not be such a large factor (Frazer, Johnson, and Sickler, 2008).

One of the greatest impressions zoos can make on long term wildlife conservation is through creating an environment that promotes a concern for complex issues such as biodiversity through plain means such as an experience of seeing zoo animals. People often protect that which they care about and therefore the more zoos and aquariums cater their guest experience to facilitate the valuation of animals more individuals that visit zoos will leave with a greater concern for conservation. Zoos and aquariums possess an incredible potential to influence the future generations of the world. The more zoos and aquariums learn about what produces the best results in regards to creating a new generation of conservationists the larger the impact those zoos will have on wildlife conservation (Skibins and Powell, 2013).

An important insight into conservation education at zoos is the understanding that many guests are simply looking for a fun place to go for the weekend. Luebke and Matiasek (2013) researched the balance between the enjoyment of the visitor versus the amount of learning that should be pushed on them. In the past zoos have been traditionally institutions of guest recreation. However, in recent years they have changed into institutions of conservation, research, and learning. This being said, it is difficult to create a proper balance between the three. The main takeaway from Luebke's research is that most guests surveyed were impacted most by the emotional experience they had with viewing the animals in their exhibit.

The value of nature plays an integral part in conservation and restoration as well. Swart, Van Der Windt, and Keulartz (2001) created a model in which one can follow that will inevitably lead the follower to see the value that nature possesses. It is based on three premises, ecological, ethical, and aesthetic perspectives of nature. Through the use of these three premises the individual can become invested in conservation and restoration. Environmental value is broken down into three philosophical premises, that which is true, that which is right, and that which is beautiful. Answering these questions in regards to zoo visitation could potentially unlock the key to better conservation education.

Based on the findings of the literature review, I became interested in a question regarding the effectiveness of two specific types of conservation messaging. Is it more beneficial to implement a take-action initiative that the guest can utilize to feel like they are making a positive change in conservation or is it more important to create an emotional connection between a species/multiple species and the guest? I designed a study using questionnaires at the University of Tennessee at Chattanooga and the Chattanooga Zoo to better understand the effectiveness of these two conservation communication tactics.

The overall goal of this project was to help better understand and assist in improving the methods zoos and aquariums employ to relate conservation messages to the public. During the researcher's employment at the Chattanooga Zoo it was noticed that zoo guests seem to be more engaged and ask more questions in chats utilizing an emotional appeal. My hypothesis is that incorporating an emotional appeal in an informational chat increases guest retention of information more than using a take-action initiative based on the responses observed during presentations at the Chattanooga Zoo.

Participants

Chats and surveys were done for two audiences, at the Chattanooga Zoo (zoo visitors) and at the University of Tennessee at Chattanooga (students). The original plan was to conduct zoo chats and surveys at the Chattanooga Zoo only; however after fourteen attempts, not enough surveys were collected. As a result, a second study location was determined. At the Chattanooga Zoo, the chats were delivered to a voluntary audience that was either passing by or saw the sign displaying a keeper chat at 3:00 PM. At UTC, the chats were delivered to an audience of students in various introductory level courses. The courses chosen were Introduction to Psychology, Introduction to Environmental Science, and Principles of Biology I. Two additional class sections of Principles of Biology I were added to the pools surveyed at UTC. These classes were added in order to have a consistent class sample population in which to gather data from, as comparison between different introductory courses could have led to greater bias more so than comparison of different sections of the same course. The students were seated in large auditorium style classrooms in which the primary researcher stood at the front of and gave the presentations.

Materials

The survey that was used during the study was a modified version of the survey used in a similar study conducted by Lukas & Ross (2005; Figure 3). The survey was scored based on how many true or false questions were answered correctly out of the total. There were twelve questions in the modified survey, the categorical type of each question are as follows: two taxonomic, three behavior, four natural history, and three conservation (Figure 4). The categorical ratio of the questions in the modified study was made to be as close as possible to the ratio in the original study given the constraints of the sample populations as well as the differences in target species. These surveys were modified based on the relevancy of the information as related to the chimpanzees at the Chattanooga Zoo as well as based on the audience. One of the main differences between the two surveys is the omission of facts about Gorillas as there are no Gorillas at the Chattanooga Zoo and therefore any information related to them would be irrelevant in this study (Figure 4). The questions that could be used for gorillas and chimpanzees

interchangeably were retained. Another difference between the two questionnaires is that the modified version omits the statement “Humans are Apes,” because certain members of our target populations could potentially focus an unnecessary amount on this statement because it is contested among religious groups (Morris 2006). These omissions also shortened the survey to a length that made it easy to complete within a few minutes.

The Chattanooga Zoo is a small zoo with a relatively small visitor base during weekdays. Originally, the zoo chats were to be given inside the Gombe Interpretive Center, directly in front of the chimpanzee inside exhibit. However, after a few attempts at giving the chat in said environment a number of conflicts arose. Firstly, sound travels very far and echoes loudly inside the center. When more than five or so guests were inside the center, especially children, the noise level significantly rose which was a significant distraction to those listening to the chat. There was also not enough space for visitors to stand comfortably within a reasonable range of the speaker. Due to these challenges the zoo presentation location was moved outside in front of the chimpanzee outdoor exhibit, in the same location that zoo keeper chats are given on a daily basis. Surveys were also passed out to individuals who had not listened to a chat in order to gauge base-level knowledge. Clipboards and pens were used in order to make it easier for individuals to take the surveys.

Procedure

Due to the amount of time available and other constraints, such as manpower and amount of introductory classes available, the two conservation hooks (approaches used to peak guest’s interest) chosen for this study were a take-action initiative related to chimpanzee conservation and an emotional appeal to the chimps at the Chattanooga Zoo. These are two commonly used approaches at the zoo. The take-action initiative informed the guest about tantalum, a material commonly found in cell phones and laptops and that is derived from a mineral heavily mined in chimpanzee habitat. This hook also informed listeners about the action they can take to help reduce the demand for tantalum and, in turn, the need to

mine in chimpanzee habitat, which is recycling cell phones and laptops. The audience was also told about where they could recycle these items, at the Chattanooga Zoo.

The emotional appeal to the chimpanzees at the zoo included some anecdotal information about the personalities of three chimps, the two alphas, Artie and Ranette, as well as Katrina, a particularly intelligent individual. These chimps were chosen due to their unique personality traits. These hooks were placed at the beginning of the same informational body of chimpanzee-related facts. A chat was also given that did not include any sort of conservation hook but simply possessed the chimpanzee information that was included in the other two chats. This chat was meant to act as a control for the other two that included conservation hooks.

The presentations were delivered orally to each audience and the attire of the spokesperson was consistent in each instance, a formal volunteer uniform. At the zoo, these chats were delivered on Fridays and Sundays at 3:00 PM due to schedule restrictions. A research assistant was present during and after each conservation chat and was located behind the crowd. This particular placement was chosen in order to optimize the amount of surveys collected. Surveys were passed out in the front of the crowd by the primary researcher and the research assistant would pass them out at the back of the crowd in order to reach the maximum amount of individuals. Each chat took roughly three minutes to deliver. The scripts for all three presentation types are located in Appendix III.

UTC students of five different introductory level classes were surveyed. One chat was given per class by the same researcher who gave the chat at the Chattanooga Zoo. The researcher was wearing the same formal zoo volunteer attire as was worn during the chats given at the Chattanooga Zoo. Surveys were dispersed at the end of the chat and administered to only those present during the chat. The surveys were dispersed in the same manner as a test, given from left to right down each row of the auditorium. The true or false questions of the survey were either circled or underlined by each student with their own writing utensils. The students were told at the end of each chat that these chats and surveys were for a research study and that any information related to informed consent was located on the back of the survey. In each class, the surveys were collected and once the researcher had left the classroom and

entered a private area the surveys were placed into an envelope that was labeled with the type of chat given to that particular class. These envelopes were stored in a secure lockbox and only opened when counting, grading, and entering surveys into excel. This research was approved by UTC's Institutional Review Board, and the permit number is 17-027.

TABLE 2. An Overview of Visitor Responses to Knowledge Questions

Category	Statement	Correct response	Percentage correct
Taxonomy	Chimpanzees and gorillas are two types of great apes.	True	71.2
Taxonomy	Humans are apes.	True	34.6
Taxonomy	Gorillas (chimpanzees) are closer to humans in their genetic makeup than are chimpanzees (gorillas).	False (True)	68.9
Taxonomy	Humans can give colds to gorillas (chimpanzees).	True	80.5
Behavior	Apes sleep in nests.	True	46.2
Behavior	Gorillas (chimpanzees) have been known to hunt and eat monkeys in the wild.	False (True)	54.1
Behavior	Gorilla (chimpanzee) infants are completely independent from their mothers after the first year of life.	False	69.6
Behavior	Gorillas (chimpanzees) spend time on the ground and in the trees.	True	90.3
Natural history	Great apes usually live longer in captivity than in the wild.	True	59.5
Natural history	This is a picture of a gorilla (chimpanzee).	50% True 50% False	True: 92.8 False: 97.0
Natural history	An adult male gorilla (chimpanzee) is called a silverback.	True (False)	73.7
Natural history	Wild gorillas (chimpanzees) spend the majority of their time in very small social groups of no more than 2–3 animals.	False	61.5
Natural history	Female gorillas (chimpanzees) have visible swollen bottoms when they are ready to mate.	False (True)	46.7
Conservation	The meat derived from wildlife in African forests is referred to as "bushmeat."	True	58.7
Conservation	All great apes are endangered.	True	78.0
Conservation	In the wild, gorillas (chimpanzees) are found in parts of South America.	False	51.5
Conservation	There are fewer than 1,000 mountain gorillas (chimpanzees) left in the wild.	True (False)	65.5
Conservation	The hunting and eating of gorillas (chimpanzees) is a substantial threat to their survival in the wild.	True	69.5
Conservation	It is illegal to own a pet gorilla (chimpanzee) in the state of Illinois.	False	7.5

Figure 3. Original Questionnaire developed by Lukas & Ross

(Lukas & Ross 2005)

Chimpanzees are great apes	True/False
Humans can give colds to chimpanzees	True/False
Apes sleep in nests	True/False
An adult male chimpanzee is called a silverback	True/False
Chimpanzee infants are completely independent from their mothers after their first year of life	True/False
Chimpanzees spend time on the ground and in the trees	True/False
Great apes usually live longer in captivity than in the wild	True/False
Wild chimpanzees spend the majority of their time in small social groups of no more than 2-3 animals	True/False
Female chimpanzees have visible swollen bottoms when they are ready to mate	True/False
There are fewer than 1000 Chimpanzees left in the wild.	True/False
All great apes are endangered	True/False
In the wild, chimpanzees are found in parts of South America	True/False

Figure 4. Modified Questionnaire

(Modified from Lukas & Ross 2005)

Results

Date	Control	Take-Action Initiative	Emotional Appeal
8/18/17	0		
8/20/17	1		
8/25/17		3	
8/27/17		4	
9/1/17	0		
9/3/17	6		
9/8/17			0
9/10/17			2
9/15/17		0	
9/17/17		1	
9/22/17			1
9/24/17			2
9/29/17	0		
10/1/17	0		

Table 1. Conservation Chat Time Table at the Chattanooga Zoo. Each number represents the amount of surveys collected on each date.

At the Chattanooga Zoo, a sign was posted at the presentation location on the days that the chat was given. Even with this sign in place guest attendance maximum was three guests on weekdays and six guests on weekends. Table 1. displays the days in which the chats were given and the amount of surveys collected on each day. After fourteen chats were given, the attention of the thesis turned to surveying UTC students and no more chats were given at the Chattanooga Zoo. Five out of the seven week days the chat was given no guests attended at all. Every guest that attended each chat filled out a survey after being asked as a group or being asked directly.

Course	Control	Take-Action initiative	Emotional Appeal
Principles of Biology I Section 1			73
Principles of Biology I Section 6	71		
Principles of Biology I Section 8		48	
Introductory Psychology	62		
Introductory Environmental Science			41

Table 2. UTC Student Survey Table. The numbers represent the amount of surveys collected in each course.

The bold numbers were used in data analysis.

Chats and surveys were given to a total of five introductory classes at UTC (Table 2). Two hundred and ninety five surveys were distributed in total. Each chat was given to a class only once. Of these five classes only the surveys collected from the three sections of the same Principles of Biology I course in bold were used for the data analysis.

At the Chattanooga Zoo, the mean score for the control group was 11.28/12 with a standard deviation of 0.49 ($M=11.28$, $SD=0.49$). For the take-action initiative group, $M=11.25$, $SD=0.89$. For the emotional appeal group, $M=10.4$, $SD=2.07$. However only five surveys were collected from the emotional appeal group and one of these scores was a 7/12 which brought the average down significantly. At UTC, for the control group, $M=8.93$, $SD=1.91$. For the take-action initiative group, $M=8.81$, $SD=1.81$. For the emotional appeal group, $M=9.81$, $SD=1.93$.

A single factor ANOVA test was run in order to determine whether the group means were significantly different from one another. The chats that were used significantly affected the survey scores, $F(2)=5.47$, $p=0.005$. This led to the rejection of the null hypothesis, there is a significant difference between the scores of the three groups. In order to determine which group or groups exhibited statistically significant difference a Tukey HSD test was applied to each of the 3 possible pairings. After adjusting for the unequal sample sizes using the Tukey-Kramer method it was determined that that there was a significant difference between the means of both the emotional appeal group and the take-action initiative

group as well as between the emotional appeal group and the control group. There was no significant difference between the control group and the take-action initiative group.

True/False Question	Principles of Biology I		
	Section 6 (Control)	Section 8 (Take-Action Initiative)	Section 1 (Emotional Appeal)
Chimpanzees are great apes	85.9%	83.3%	84.5%
Humans can give colds to chimpanzees	98.6%	89.6%	95.8%
Apes sleep in nests	87.3%	77.1%	85.9%
An adult male chimpanzee is called a silverback	46.5%	66.7%	76.1%
Chimpanzee infants are completely independent from their mothers after their first year of life	74.7%	77.1%	74.7%
Chimpanzees spend time on the ground and in the trees	95.8%	98.0%	97.2%
Great apes usually live longer in captivity than in the wild	85.9%	79.20%	87.3%
Wild chimpanzees spend the majority of their time in small social groups of no more than 2-3 animals	62.0%	58.30%	70.4%
Female chimpanzees have visible swollen bottoms when they are ready to mate	97.2%	89.6%	94.4%
There are fewer than 1000 Chimpanzees left in the wild.	47.9%	62.5%	71.8%
All great apes are endangered	67.6%	56.3%	74.7%
In the wild, chimpanzees are found in parts of South America	50.7%	39.6%	62.0%

Table 3. UTC Student Percent Scored Correct Per Question. The true/false questions on the left-hand side of the table are questions one through twelve from top to bottom.

All three groups tended to score higher on questions two, six, and nine. All three groups tended to score lower on questions four, eight, ten, eleven, and twelve. The control group had the highest percentage scores on questions one, two, three, and nine. The take-action initiative group had the highest percentage scores on questions five and six. The emotional appeal group had the highest percentage

scores on questions four, seven, eight, ten, eleven, and twelve.

Question Type	Principles of Biology I		
	Control	Take-Action Initiative	Emotional Appeal
Taxonomy	92.3%	86.5%	90.4%
Behavior	83.6%	84.0%	86.3%
Natural History	72.9%	73.4%	82.5%
Conservation	55.4%	52.8%	70.3%

Table 4. UTC Percentage Answered Correctly Per Question Type.

On average, each group scored lower on conservation-based questions and scored higher on taxonomy based question. The control group had the highest overall percentage with a 92.3% in the taxonomy category. The take-action initiative group had the lowest overall percentage with a 52.8%.

Discussion

Based on the mean scores of each of the UTC student groups the emotional appeal group scored highest on average. This implies that there is a possible relationship between the type of conservation hook and the score received on the questionnaires. I hypothesized that the emotional appeal would influence guest retention of information more so than a take-action initiative approach. Based on the findings of the study the null hypothesis is rejected, there is a statistically significant difference between the means of the three chats. The mean score of the emotional appeal group was determined to be statistically significantly different than that of both the control group and the take-action initiative group based on the results of the Tukey HSD Test. This suggests that the emotional appeal tactic produces a significant difference in scores while the take-action initiative tactic does not. The mean score of the control group was higher than that of the take-action initiative group which was not expected. This result suggests that putting the cell phone recycling take-action initiative at the beginning of an informational

chat would most likely have no significant effect on guest retention. The findings of this study were in line with the research conducted by Skibins & Powell (2013) of which the researchers found that their results support the role zoos can play in fostering a connection to wildlife and stimulating pro-conservation behaviors through creating an emotional connection with the animals at a zoo.

While the results of this study conclude that the take-action initiative group most likely had no effect on guest retention of information based on the result of no significant difference between the means of the control group and the take-action initiative group, take-action initiatives have been shown to be effective in providing guests opportunities to actively participate in conservation behaviors (Pearson, Lowry, Dorrian, & Litchfield, 2014). Based on the findings from this study as well as the findings of Pearson, it would be potentially beneficial for future research to look at the effects of placing take-action initiatives at the end of zoo chats, possibly incorporating both an emotional appeal and a take-action initiative into a single chat. This suggests that zoos and aquariums should focus more heavily on creating an emotional connection between the specific animals at the zoo at the beginning of zoo presentations rather than outright emphasizing conservation action that guests can take at the beginning of zoo chats. As Skibins suggests, the data supports the idea that zoo goers are concerned most with what they value and therefore creating an emotional connection with zoo animals has an impact on guests, in this case, a potential impact on their retention (Skibins & Powell 2013).

Future research could include testing multiple approaches in combination, such as an emotional appeal followed by a take-action initiative. Future research should also explore the impact of emotional messages on retention of zoo-based information. Also, while collecting surveys from UTC students did yield a larger number of surveys, the results gathered from this population may not have been as representative of zoo guests as those collected at the Chattanooga Zoo. In the future, any research related to this topic should consider strongly the location, marketing, prestige of presenter, as well as audience size of the intended study site. Other approaches could also be incorporated into future studies, such as those containing thought-provoking questions such as, what is the value of nature, which could potentially peak the guest's interest and increase retention (Swart, Van Der Windt, and Keulartz, 2001).

Another potential approach that could be tested in the future and was considered for this study was a shock tactic that stresses the urgency of conservation, citing specific rates of species loss alongside other shocking statistics. This tactic was not implemented due to time constrictions.

There were a number of limitations discovered over the course of this study. Figure 5. demonstrates the small guest turnout to the chats given at the Chattanooga Zoo. As a result of these intimate audience sizes the guests were completely engaged in the chat and scored almost perfect if not perfect scores on the surveys showing no significant difference between the already limited amount of surveys collected. A ceiling effect was observed in these groups in that the independent factor (conservation message) no longer effected the dependent factor (survey score) due to the small and engaged sample size. The study was modified and the audience changed to students of introductory level courses, a guaranteed large audience because of this failure to collect a representative and accurate sample. Due to the lack of guest attendance in the initial survey location, alternative survey tools were developed and utilized. The surveys were no longer cut out into rectangular pieces that would fit on the clipboard. The use of clipboards and pens was discontinued as well. Another considerable limiting factor was the prestige of the presenter. All of the chats were given by an individual wearing a Chattanooga Zoo volunteer shirt. This could have influenced how much credibility the audience gave to the speaker and in turn how much information they retained (Frazer, Johnson, & Sickler, 2008). The credibility of the speaker could have also varied between the Chattanooga Zoo groups and the UTC groups. There was also poor advertisement of the conservation chats at the Chattanooga Zoo. While a sign was put out in front of the survey location on the days the chats were given this proved to be ineffective at rousing large groups to show up to the chats. Another limitation of the study is that the UTC student survey population primarily used to determine the relationship between the zoo education approaches and guest retention was not representative of zoo guests. For one, the guests at the zoo would be standing outside, physically in front of the chimpanzee exhibit and though the chimps were rarely visible from this position while the chat was given, they could see them from other vantage points before or after the chats. At UTC, the

students were sitting down indoors, in a classroom setting, and were not near the chimpanzees immediately before, during, or after the chats.

This study presented relationships between different zoo chat approaches and suggested that there is a statistically significant difference between creating an emotional appeal with a zoo animal as opposed to utilizing a take-action initiative or having no conservation hook at all, in regards to guest retention. If the Chattanooga Zoo were to consider these results, avoiding the pitfalls discovered in this study and utilizing the lessons learned, the zoo might conduct research in the future that could potentially lead to more efficient zoo chat methodology. Also, the adoption of an emotional appeal at the beginning of keeper chats might influence guest retention of information, conceivably leaving a greater impact on those who visit the zoo and potentially influencing pro-conservation behaviors in the process.

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Appendix I

HISTORY OF ZOOS TIMELINE

24th century BC	· 1st Animal Park in the Sumerian city of Ur in 2300 BC.
15th century BC	· 1st recorded animal-collecting expedition (exotic birds and monkeys) by Egypt's Queen Hatshepsut to current day Somalia.
14th century BC	· Assyrian rulers exchanged exotic animals for each other's zoos.
10th century BC	· Emperor Wen Wang of the earliest Chinese Dynasty had an animal park he called "Garden of Intelligence," designed so he could study and learn about wildlife.
5th century BC	· Constantinople Zoo: Monkeys and lions in closed pens, and elephants, giraffes and buffaloes had run of large enclosures.
4th century BC	· Alexander the Great was gentle and careful with his collection of elephants, bears and monkeys. He left his collection to King Ptolemy I of Egypt, who established the first organized zoo. Aristotle observed the animals in this collection, and wrote History of Animals, describing 300 species of vertebrates.
1st century	· Romans used animals for entertainment in their coliseum; held animal fights where thousands of animals were killed daily.
13th century	· Animal collections again in vogue. ^[1] _{SEP} · Frederick II (Sicily) established several large animal ^[1] _{SEP} collections, and also had several exhibits travel around Europe, influencing other rulers to establish their own animal collections. ^[1] _{SEP}

Page 3

16th century	· Conquistador Cortes went to Mexico and found a zoo unlike anything Europeans had imagined: pens with bronze bars housing pumas and jaguars, huge basins of fish, hundreds of keepers working to keep the grounds neat. As European explorers came back from the New World, they began to build animal parks in Europe ^[1] _{SEP} · The most enlightened zoos at that time were set up by Akbar of India. By the time he died in 1605, his zoos housed 5,000 elephants and 1,000 dromedaries and camels. He forbade any form of animal fights, employed people trained in veterinary medicine, and had his zoos open to the public. ^[1] _{SEP}
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18th century	<ul style="list-style-type: none"> • People taking power away from royalty. Animal collections became more accessible to all. • Captive collections of wild animals were called “menageries”. • The animals were still looked at as curiosities. Focus on spectator, not animal’s needs. • Animals from the menagerie at Versailles, and many others, were sent to Jardin des Plantes, which was designed to be a collection of scientific value. This was the beginning of the idea of the zoological garden. • In the U.S., zoos and menageries toured the country, and eventually were established in growing communities. Many North Americans traveled to other continents for the adventure of hunting big game. The perception was that the supply of wild animals was endless.
19th century	<ul style="list-style-type: none"> • The democratization of Europe & the rise of industrialism gave rise to the “modern zoo”...a place where exotic animals could be studied & relationships with universities were established. • Development of large cities and increasing wealth led to the preservation of natural areas & parks. Plants and animals were exhibited together. • The Zoological Society of London founded the zoological gardens at Regent’s Park in 1828, the first “modern zoo.” It influenced zoological gardens across Europe. • In temperate areas, tropical species had to be housed indoors: massive, steam-heated artificial systems. • Cement floors and tiled walls which could be wiped down, because of fear of disease. • Because of need to raise funding for zoos there was a focus on big, dangerous animals that would excite/attract the public.

Page 4

1874	<ul style="list-style-type: none"> • U.S. zoos began to be established. The 1st technical zoo in America was the Philadelphia Zoo (though the Lincoln Park and Central Park Wildlife Centers were established first, eventually becoming zoos). Washington, D.C. and the Bronx Zoo followed.
1895	<ul style="list-style-type: none"> • The Wildlife Conservation Society was formed, “encouraging and advancing the study of zoology...furnishing instruction and recreation to the people”, promoting “cooperation with other organizations in the preservation of the native animals of North America and encouragement of the growing sentiment against their wanton destruction.”
20th century	<ul style="list-style-type: none"> • There were 23 zoos in the U.S. by the early 1900s, however animal management was inadequate, and there was little learning going on at zoos for the public. • Animal shows were common. Zoos were designed for the ease of care and cleanliness, with little regard for the animals’ needs. This was called the “toilet era” because of the tile and concrete cages. The animal’s cages had no hiding places and no objects in the cages. • Getting animals from the wild was becoming increasingly difficult. Many species were disappearing. Governments were now trying to make money from the sale of their animals. The difficulty and cost of acquiring animals led to the need to improve the surroundings and decrease mortality rates of captive animals. • Development was interrupted during WWII, and didn’t resume again until the 1950s. • Dr. Heini Hediger of the Basel Zoo in Switzerland (1944-53) and the Zurich Zoo (1954 until his death) had a major influence on

	zoo design and animal care, focusing on continuing to meet the animals' physical, psychological and social needs when they are brought from the wild to the zoo. ^[1] _{SEP}
1907	· Carl Hagenbeck came up with the idea to exhibit animals in a more natural setting, at the visitor's eye level..cages without bars, stage-like platforms separated from the public by moats. The use of moats allowed Hagenbeck to display predators and prey to appear to be in the same exhibit. The public was beginning to see the interrelationship between animals.

Page 5

1930's	· Roosevelt's Public Works Program gave zoos the manpower for modernization and repair.
1962/1963	· Ivan the Gorilla was captured in the wild as an infant and began his journey to the United States
Late 1960's	· More consideration was given to conservation and the treatment of animals. ^[1] _{SEP} · Education departments took on a bigger role, and volunteer departments were formed to help in education of the public. ^[1] _{SEP}
1970's	· Increasing concern about the treatment of zoo animals. The AZA (Association of Zoos and Aquariums) was formed as a means for self-monitoring standards. ^[1] _{SEP} · There was more cooperation among zoos, more research, great advances in medical technology. The concept of "landscape immersion" was developed at the Woodland Park Zoo, putting animals a naturalistic environment and bringing the visitor into the environment. ^[1] _{SEP}
1980's	· The country's wealth allowed U.S. zoos to make enormous facilities improvements.
1990's	· Zoos reach out beyond the zoo to impact the protection of animals in their natural habitats. AZA reversed its priorities – conservation, education and scientific study come before recreation.
1994	· Ivan the Gorilla is relocated to Zoo Atlanta after Woodland Park Zoo, Zoo Atlanta and PAWS (Progressive Animal Welfare Society), spearheaded the campaign to move Ivan from the mall so he could be socialized with his own species.
21st century	· Zoo's take advantage of technology (i.e. interactive exhibits, videos, social networking, web-cams, etc) to spread word about conservation and connect zoo visitors with the animals in the zoo as well as around the world.

(Woodland Zoo, 2017)

Appendix II

Take-Action Initiative Script

Hello everyone and welcome to the Chattanooga Zoo. I would like to get started with talking about a bit of chimp conservation. In each and every one of your cell phones and laptops there is a material called Tantalum. This element is synthesized from coltan, a metallic ore that is heavily mined in the habitat of Chimpanzees. By recycling your cell phone, tantalum can be reused, the demand for the substance is ultimately reduced and in the process you are in turn helping chimpanzees in the wild. We have a recycling station (here) at the Chattanooga Zoo that will provide easy recycling should you choose to do so. Chimpanzees are great apes. Humans can give colds to chimpanzees. Apes sleep in nests. Chimpanzee infants are still dependent on their mothers after the first year of life. Chimpanzees spend time on the ground and in the trees. Great apes usually live longer in captivity than in the wild. Unlike gorillas, adult male chimpanzees are not called silverbacks. Wild Chimpanzees spend the majority of their time in very large social groups. Female Chimpanzees have visible swollen bottoms when they are ready to mate. All great apes are endangered. In the wild, chimpanzees are found in Africa and nowhere else. (Adapted from Survey developed by Lukas & Ross 2005 & Chattanooga Zoo Chimp Chat)

Emotional Appeal Script

So before I tell you about chimpanzees I would just like to talk about some of the chimps we have at the zoo. We have seven chimps total, each with their own very unique personality. Arty, our alpha male, loves children and you can often see him at the windows interacting with kids as they pass by. Ranette is the alpha female and acts sort of as the peacekeeper of the group. If any of the chimps start getting rowdy she will come over and stop them with a big bear hug. Katrina is our smartest chimp. She is the best at solving puzzles and picks up on new training techniques very quickly. Chimpanzees are great apes. Humans can give colds to chimpanzees. Apes sleep in nests. Chimpanzee infants are still dependent on their mothers after the first year of life. Chimpanzees spend time on the ground and in the trees. Great

apes usually live longer in captivity than in the wild. Unlike gorillas, adult male chimpanzees are not called silverbacks. Wild Chimpanzees spend the majority of their time in very large social groups. Female Chimpanzees have visible swollen bottoms when they are ready to mate. All great apes are endangered. In the wild, chimpanzees are found in Africa and nowhere else. (Adapted from Survey developed by Lukas & Ross 2005 & Chattanooga Zoo Chimp Chat)

Control Script

Chimpanzees are great apes. Humans can give colds to chimpanzees. Apes sleep in nests. Chimpanzee infants are still dependent on their mothers after the first year of life. Chimpanzees spend time on the ground and in the trees. Great apes usually live longer in captivity than in the wild. Unlike gorillas, adult male chimpanzees are not called silverbacks. Wild Chimpanzees spend the majority of their time in very large social groups. Female Chimpanzees have visible swollen bottoms when they are ready to mate. All great apes are endangered. In the wild, chimpanzees are found in Africa and nowhere else. (Adapted from Survey developed by Lukas & Ross 2005)