2012

# Influencing opinions about bats the impact of levels of interaction during educational presentations

Samantha Hynes
*University of Central Florida*

# INFLUENCING OPINIONS ABOUT BATS: THE IMPACT OF LEVELS OF INTERACTION DURING EDUCATIONAL PRESENTATIONS

by

SAMANTHA HYNES

A thesis submitted in partial fulfillment of the requirements
for the Honors in the Major Program in Psychology
in the College of Sciences
and in The Burnett Honors College
at the University of Central Florida
Orlando, Florida

Fall Term 2012

Thesis Chair: Dr. Matthew Chin

## ABSTRACT

This experiment was run to see whether the educational presentations done at zoos and other educational facilities are effectively changing patrons' negative misconceptions about the animals they were seeing. Participants were invited to attend one of three educational presentations, where they were exposed to either a low, intermediate or high level of interaction involving a bat. I hypothesized that regardless of the level of interaction, participants would learn the information, but that a higher level of interaction would cause the biggest perceptual change in terms of how participants felt about the bat and the highest degree of learning. Across the board, participants increased their factual knowledge, with no significant differences between the baseline, taxidermy or live bat conditions. The taxidermy group had the largest difference in attitude change, but the live bat did have a role in influencing participants' views as to whether bats were beneficial to the environment. These results imply that educational facilities can use a taxidermy bat or a live bat with their patrons and depending on how they utilize the inclusion of the interactive stimulus, it will cause perceptual and educational differences.

## ACKNOWLEDGMENTS

Thank you to Heather and the City Bat Conservancy. Without your guidance and support, this wouldn't have been possible. To Dr. Chin, Dr. Sims, Professor Ihde and the ACAT lab at UCF, I couldn't have asked for a better group to guide me and challenge me along the way. Thank you for your fantastic input.

# TABLE OF CONTENTS

# TABLE OF FIGURES

# Introduction

For every teacher in existence, it could be said that there is a different teaching style. No two teachers are exactly the same, and his or her methods for imparting information (while the information covered may be similar) are almost universally as diverse as the teachers themselves. It is of great importance to educational systems as a whole to understand which methods seem to be the best for imparting information to their students. Along with the idea that the way the information is presented is particularly important to learning and imparting information, teachers often serve to "make a difference." From college students to younger children, it is of utmost importance that teachers have an influence on how students perceive events going on around them. Through this education, educators can change *perception*, the way people view ideas from a conceptual standpoint, whether it is to enlighten students of risky activities they believed were safe, or to make students aware of beliefs they may hold to be true, but are actually just popular hear-say.

In order to explore whether educational programs are making a difference in contributing to changing negative opinions, I partnered with the City Bats Conservancy to determine whether the public is actually changing its negative attitudes about bats. This research looked at whether increased levels of interaction with a bat had an influence in changing these negative opinions and solidifying the educational messages the Conservancy wishes to relay. The City Bats Conservancy aims to educate the public about bats because they are often misjudged as pests, even though they make a substantial contribution to our daily lives and the functioning of a balanced environment.

**The Importance of Changing Attitudes**

A problem of considerable importance in the zoological community is the recent death of bats due to White-nose syndrome. Although there is no cure for White-nose syndrome so far, and it is a poorly understood disease, it is believed that it is perilous to bats for people to interrupt the bats while they are hibernating. White-nose syndrome causes abnormal bat activity, including interference with hibernation leading to depleted fat reserves and ultimately death. Humans are viewed as a possible cause for the spread of White-nose syndrome because people may travel from an infected cave site to a clean one, taking the disease with them. Due to the uncertainty regarding the cause and spread of White-nose syndrome, there are many petitions to close off caves to humans while further research occurs (Bat Conservation International, 2012). The U.S Fish and Wildlife Service (2012) estimates that at least 5.7 to 6.7 million bats have died as a result of exposure to White-nose syndrome. This statement from the U.S Fish and Wildlife Service stresses the importance of bats to the community due to their agricultural contribution of consuming bugs that would either destroy plants or spread disease. This sharp increase in the death rate of bats is not only a problem for the bats, but also a problem for humans, because without bats, these quoted agricultural contributions would disappear, requiring millions of dollars to be spent to replace the natural efforts of bats. With all of these environmental pressures that bats are facing, one of the most effective means of contributing to helping bats is to educate others. While research on White-nose syndrome is still occurring, the public needs to be educated so that they are not unintentionally spreading the disease, or adding any more weight to the environmental stressors facing bats. Part of the reason that my research focuses on the best way to change attitudes and relay information is that a positive attitude goes a long way when it comes to changing perceptions and making an initiative to help. If people heed the message that

bats are extremely beneficial to the environment, they may be more willing to sign petitions to close off caves to protect bats at risk of being affected by White-nose syndrome. Additionally, they may spare some of their dead trees, or put up bat houses to provide bats with a safe habitat, in which they can reproduce. Because bats are incredibly slow to reproduce (1-2 pups a year), having a safe environment where a maternity colony can roost is of the utmost importance for the survival of individual bat species. Furey, Mackie and Racey (2011) looked at the reproductive cycles of bats in Vietnamese karsts, and correlated reproductive decline with increased tourism and other human activities in areas where bats were present. Woodruff and Ferguson (2005) address the issue that new habitats for bats are not being created nearly as quickly as they are being destroyed, and that other small human actions such as using pesticides, or degrading water qualities, may have some effect on roosting colonies as well. The more that people are educated, the more likely the people who are informed are to be more environmentally conscious in terms of tearing down trees, demolishing sheds, visiting caves or purchasing certain foods grown with insecticides. It is extremely important that educators find the best way of transmitting this information to the public, and attempt to change the attitudes that some people have about bats, because a presentation that does not effectively present the information may be harmful instead of helpful. Finding the most interactive and entertaining means of relaying the information should be central to having the biggest impact on participants' views, and hopefully will cause those participants who receive the information to contribute to preserving bat habitats in the community.

**Background**

In order to design the most effective experiment to see if the educational exhibits in existence are actually effective in producing the desired results of attitude change and educational impact, I wanted to see what experiments had been done in the past. It was important in this research to find what methods had been used to manipulate levels of interaction, and to give me a basis for finding whether there were any implications that the manipulation would actually be effective. While there is a wealth of information in existence about general manipulations on levels of interaction, there was significantly less information present about interactions with animals, and perceptual changes as a result of those manipulations.

Costa, van Rensberg and Rushton (2007) took two different groups and randomly assigned students to either a group with an interactive lecture or a standard Power Point based lecture. All students attended 12 one hour sessions, run by two different instructors with similar experiences. The interactive group consisted of a discussion that was dominated by the students, and did not have a Power Point but rather a white board and a pen. The two measures of primary importance were student satisfaction and student performance on the end-of-placement assessment. Students had a higher satisfaction level with the presentation in the discussion group and also performed significantly better on the assessment than those in the lecture group. The interactive discussion group had better results on knowledge retention and a follow-up written test than did the group that was lecture-based, but non-interactive. This supports the idea that learning that requires more than just passive attention is better for the participating students. When the students feel that they can control the discussion, or that they are actively involved, they learn more and enjoy participating more.

Similarly, Ochoa and Wludyka (2008) looked at levels of interaction in presenting educational material. They randomly assigned medical students who were studying seizure disorders to be either in the web-based group or a control group that dealt with traditional written material. Interactive modules were present in the web-based study, with immediate feedback for questions, and other supplemental materials to assist in learning the factual information. A multiple-choice test was given to the participants to assess what the students had learned about seizure disorders, and results showed that there was a significantly higher mean test score for the interactive web group, and no statistically significant difference between participants' attitude towards learning, motivation or feedback perception. This demonstrates that additional interaction or supplemental material can have an effect on the degree of learning that occurs compared to the traditional non-interactive teaching methods.

Outside of just differing levels of interaction, there are other factors that can influence how well people retain information being presented to them. Shams and Seitz's (2008) research suggests that multisensory learning is more beneficial than uni-modal learning because our brain interprets real situations both through auditory and visual stimuli. Shams and Seitz's research focuses on the idea that the human brain has a physical predisposition that supports multisensory learning. Pairings of auditory and visual stimuli (or in my study's case, tactile and visual stimuli) create an environment for better recall. This previous research suggests that the best method to get the patrons of the Conservancy to retain the knowledge that they receive in the informational session is to include both visual and tactile stimuli as well as verbal information that inspires the students to pay attention and *interact* with the stimuli provided. This method is much more

involved than other methods, such as simple lecture-style informational sessions, or just textual information with no personal delivery.

Another factor that can influence how well people retain information is how hands-on an activity is. The more interactive and hands on, the more attention that is paid, the more learning that occurs. Wishart and Triggs (2010) looked at the effects of interactive learning with young students in museums. One of the things about museums that are thought to be the most influential and relevant to learning is the handling of artifacts. If students are able to physically interact with real objects from the museum, they will be more interested and attentive and learn more. As long as teachers can reference the information learned on the field trip in the classroom, the educational field trips have shown to be a positive influence on the learning of young students. These studies allowed students to go to a museum, interact with an exhibit, research that exhibit using smart technology, take photos and other documentation, and then required them to teach what they learned to their peers. The effects that this interactive, peer-educating had were that there were deeper levels of student engagement in their education, and more questions being asked by students. This higher interaction of the students could be one of the reasons that they learned more. If they are more involved and interested in the material, they are more likely to pay attention to the information and actually retain what is being said. Results showed that students most enjoyed and learned the most when they were interacting hands-on with artifacts from the museum. This suggests for my research that a multi-sensory, interactive presentation will be the most entertaining and engaging, which will promote the most interest and learning.

While it is the hope of the Conservancy that any exposure to education will allow their patrons to reconsider false beliefs they have about some of the animals they do not interact with often, I am hypothesizing that any exposure to information (the educational presentation) that does not support the incorrect and negative concepts will cause at least a minor change because of previously documented studies regarding stereotypes and mere exposure to information regarding those stereotypes, such as the results seen in the Zebrowitz, White and Wieneke study (2008). One reason that I believe, regardless of the level of interaction, that educating people will change their negative (and often false) perceptions is that people come to like what they are exposed to. This is the "mere exposure" hypothesis, which states that by exposing an individual to an unfamiliar stimulus, they will have increasingly positive feelings toward that stimulus in the future. Zebrowitz, White and Wieneke (2008) found that exposure to a set of photographs of individuals from a different race caused increased liking for a subsequent set of pictures (from the same differing race) that had not yet been seen. These findings were consistent when trials were run with white individuals viewing photographs of Asian faces as well as black faces. These results were generalizeable, showing that exposure to one face caused successive increased likeability for the others. Effects were not significant for same-race participants, confirming that the effect occurs with unfamiliar stimuli, causing people to have increased liking for what they have just been exposed to when they are exposed to it a second time. For my research, it is my hope that by merely presenting people with pictures of bats, it will educate them and present them with images they may not have seen before. By seeing a concrete image of what a "normal" bat looks like, they may be able to negate some of the misconceptions they

had, and have increased liking for the next bat that they see just because of being exposed to the initial picture.

Tausch and Hewstone (2010) looked at personality traits as they related to stereotype change, and found that individuals who initially conformed to ageism were more likely to change their minds about a particular stereotype if they interacted with an individual that moderately (not radically) differed from the stereotype. Participants took a survey to assess their initial attitudes toward the elderly, using stereotypical and counter-stereotypical traits. Then, participants were divided into one of four conditions, where they were presented with information about a person and a paragraph about him. The participants were then presented with stereotype consistent or inconsistent statements, and then participants were asked to rate the suggested person on his "typicality". They took the same survey that they had taken prior to the experiment. Results showed that the moderately inconsistent information was the most effective. This suggests for my research that the highest degree of change may be seen in a condition that has the highest level or second highest level of interaction with the bat stimulus that is provided in my experiment because it depicts a bat in its natural environment. This allows the participants to look at the bat up close, and see that all bats are not "flying rodents," or "blood-sucking pests" that consistently get tangled in your hair. Rather, the participants get to see a bat interacting with its environment, much like they would see a bird or flying squirrel in its own enclosure acting naturally. However, this research also warns that trying to change the image of bats into a "cute and cuddly" or "friendly" animal may be "crossing the line" into the territory of extremely counter-stereotypical information, and be ineffective because it is too inconsistent with the participants' own views.

Based on these studies, the three levels of interactions that are being compared are (1) informational presentations with interaction with bat bio-facts only (replicated wings, bones, interactive wingspan demonstrations, and bat houses), (2) interactive presentations with bio-facts as well as an actual taxidermy bat, and (3) interactive presentations with bat bio-facts as well as a live bat present for the public to examine visually. The Lindemann-Matthies and Kamer (2005) study specifically looked at whether exhibits that are interactive in zoos are more educationally valuable, and questions whether they result in longer-lasting retention of learned information. Half of the participants had access to a touch table as well as educational information about vultures during the day, and half of the participants only had access to the educational information. Participants filled out a survey both before and after their interaction with the educational exhibit. They found that the interactive method of educating the public is the most effective because it accommodates for the lack of previous knowledge and understanding by taking the visitor step-by-step through features that are not otherwise available in a text-only educational environment. They also found that the visitors found the touch-table exhibit to be more enjoyable. By providing an environment that is enriching and interesting, it promotes the most amount of opportunity for the individuals visiting the zoo to create their own agenda, while continuously interacting with the environment in which they are most interested and continuing to learn.

Swanagan (2000) had visitors at a zoo interact with an elephant bio-fact cart. He gave them an exit-survey to determine their feelings and prior knowledge about elephants, and to see if they enjoyed the interaction with the bio-facts. Additionally, participants were asked to sign a petition to determine the level of experience they had with the exhibit. Visitors were given the

option to write a solicitation card stating their views on stopping the moratorium on ivory sales. Participants who interacted extensively with the bio-fact experience were more positively influenced to support conservation messages because they had a personal interaction, as opposed to individuals who did not participate in any kind of hands-on activity. These results suggest that an interactive method is the best because it exposes the patron to an animal in its natural environment, where they can create their own personal experience with the animal. The patron can then sympathize when he is told of some kind of destruction occurring in the animal's wild habitat, such as the elephants and the petition to ban sales of ivory.

Anderson et al. (2003) hypothesized that visitors who stayed longer and watched animals interacting with a trainer would have a more positive educational experience with the zoo. Visitors at the otter exhibit had their observation time recorded, and then filled out a questionnaire. Participants witnessed a script being read that interpreted otter behavior, and/or described training sessions that were occurring in some of the observations. The four conditions were: baseline, interpretation condition, training condition, or training with interpretation condition. As hypothesized, the visitors that participated in the interactive training sessions, or the regular training sessions, reported significantly more positive feelings and viewed exhibits for more extended periods of time than when they did not view an interactive training session. This supports the idea that a more extensively interactive presentation will be more captivating to the viewing audience, and also supports the idea that participants will pay closer attention when more interactive demonstrations are present, and this heightened attention may cause a higher degree of learning and perceptual change.

**Ways in which Bats Help Humans**

It is clear that bats are commonly misunderstood, regardless of their positive contributions to the environment. Bats have saved upward of at least $3 billion dollars a year in pest control taxes for the agricultural industry. With the loss of merely one million bats, (6.7 million are estimated to have died due to White-nose syndrome alone), Western Farm Press (2011) estimated that 660-1320 metric tons of insects are no longer being consumed by bats, which could serve as a serious problem for the agricultural industry in the future. However, outside of their agricultural and environment assistance, they have other less well known contributions as well. From taking part in the pollination of the agave plant (a key ingredient in tequila: no bats, no tequila) and other fruit plants (which have significant impact in regenerating rainforests) to making medical contributions via healing properties in their saliva, bats have made a silent, but significant impact in many different fields relevant to our daily lives (Bat Conservation International, 2011).

While bats face a multitude of problems that are naturally occurring as by-products of humans, such as the possible partial spread of White-nose syndrome and habitat destruction, they also face direct threats due to the generally negative attitude they face in society. It is the goal of my experiment to see if negative attitudes can be changed by means of presenting and educating the patrons of the Conservancy about bats and their contributions, to make an impact on the way people naturally view bats. The results of my experiment will be very important for the implications about the educational programs at the Conservancy, as well as to other animal-based recreation parks, and possibly informative to the scientific community in relation to the general attitude towards bats and their contributions.

One of the main questions that the Conservancy wants answered is, “Is the information helping to change the negative perception people have about bats?” I hypothesized that exposure to any level of the information presented such as the agricultural benefits, getting to actually see a bat up close or interact with a live bat, will change the perception of bats as “pests,” but the message will be best remembered and have highest degree of change with the most interactive method of teaching. This means that participants who actually view the bat, as well as interact with the bat bio-facts, will have their perceptions changed the most, but all groups will change their minds slightly and significantly.

# METHOD

## Participants

Participants were invited to participate on the UCF SONA website, which lists current experiments that are running at the school. Participants had the choice of three different timeslots they could sign up for, but were not told about the differences between the presentations. All participants were students from a large Florida state university. There were 10 males and 26 females in the baseline condition, with age ranges from 18 to 23. There were 4 males and 16 females in the taxidermy condition, with age ranges from 18 to 20. There were 17 males and 21 females in the live condition, with age ranges from 18 to 22. No compensation was given, but participants received extra credit for participating, and some fulfilled a course requirement for General Psychology by participating.

## Materials

Participants were asked to complete a survey when they first entered the room where the presentation took place. This survey assessed their current perception of bats and their knowledge about the positive contributions of bats prior to completing the experiment.

The following questions were on the survey given to the participant. Participants received the same survey before participating and after participating in the educational demonstration. Each question was followed by either a rating scale, true or false option, or a blank after each question.

1. What are your overall feelings about bats?

Extremely negative, negative, neutral, positive, extremely positive

2. I feel that bats are beneficial to the environment.

Strongly agree, agree, undecided, disagree, strongly disagree

3. Bats have a role in the production of tequila.

True or False?

4. Bats **often** transmit rabies to humans or other animals.

True or False?

5. Bats are blind/ have terrible vision.

True or False?

6. Bats are more closely related to primates than they are to rodents.

True or False?

7. How many mosquitoes do you think a small bat can eat in an hour?

_____

8. Bats have helped contribute to the medical field in treating stroke victims and heart patients.

Strongly agree, agree, undecided, disagree, strongly disagree

9. Bats pose only a minimal threat to humans if they are not being handled.

Strongly agree, agree, undecided, disagree, strongly disagree

10. Many bat species are quickly becoming endangered.

Strongly agree, agree, undecided, disagree, strongly disagree

11. Vampire bats feed primarily on human blood, and are dangerous to anything that they feed on.

Strongly agree, agree, undecided, disagree, strongly disagree.

Appendix B shows a preview of the slides used in the educational presentation. In the educational presentation, bat bio facts were used. These consisted of examples of fruits that bats pollinate, a bat house, raw spaghetti noodles to demonstrate the brittleness of bat bones, a piece of latex to demonstrate bat skin, a piece of cloth (6 ft in length) demonstrating the length of the Flying Fox's wingspan, and pictures to illustrate different species of bats in the world. Additionally, a taxidermy bat that died of natural causes was present for one condition. This taxidermy bat looked very similar to the live bat that was to be present in the following condition. The size of both bats was about the same, and the taxidermy bat had a neutrally posed face. A live bat was present through the final condition. The live bat was an evening bat, one of the two most commonly sighted bats in Florida. The bat itself has a body that is two inches from head to feet, and a wingspan of about eight inches. The bat had its wings folded around itself for the majority of the time the participants observed it, so the bat was about the size of an ordinary small leaf. The size of the bat is extremely important, because the general remarks as the bat was being observed were that she was significantly smaller than the participants would have imagined. A larger bat could have been used, but because evening bats are a typical representation of the Florida population of bats, it was important to use a bat that was

representative. It is also important to know that any results that occurred are as a result of the implementation of a very small stimulus (the bat), in a restricted setting.

**This image depicts an evening bat, the type of bat used for the presentation.**

In order to collect all of the information for this presentation, and to accurately ensure that I was representing the information being presented in a typical zoo or Bat Conservancy encounter, I attended a bat presentation at the Central Florida Zoo, and a bat presentation from the City Bat Conservancy. I took notes on all of the information presented, the materials used, and modeled my Power Point off of the highlights of each presentation. My Power Point was very similar to that of the City Bat Conservancy standard presentation, so any results that are observed as a result of attending this presentation would be easily applicable to the presentations for the Conservancy.

**Procedure**

Participants were given a number by which they could be identified and picked one of three slots in a day to attend an educational presentation. Participants completed a survey upon entering the room that assessed their feelings about bats. Participants then attended one of three

40 minute informational sessions. In the first informational session, participants took part in an educational demonstration that involved handling bat educational props (known as bio-facts), such as a bat house, interactive wings, and listening to the educational brief that all groups heard. The second session consisted of the same educational brief and bio facts, but had an additional taxidermy bat figure that participants examined. Although participants could physically hold the placard that the taxidermy bat was affixed to, the bat was wrapped in a protective plastic so participants could not actually touch it. The third informational session consisted of the same educational brief with all of the bat bio facts, as well as a live bat present for people to see in its enclosure. The bat was overseen by a volunteer from the City Bat Conservancy to ensure it remained in its enclosure, as well as to protect it. Participants were not allowed to touch or interact with the bat in any way other than visually examining it. Each educational presentation was presented by me to ensure that each group of participants received exactly the same information, outside of the manipulated variables. It is important to add that having the volunteer from the conservancy was a very small manipulation that was added to the presentation. She sat on the side with the bat hidden in its enclosure until it was time to bring the bat out. I introduced the volunteer once I was ready for the bat to be presented, but up until the bat was being shown, none of the participants had any reason to pay attention to the volunteer. Additionally, the volunteer appeared very neutral in terms of the clothes she wore and any items she had with her. The room itself was also a standard presentation room with no additional adornments. Information presented in the educational session was tailored around the negative perceptions that most people have. The main points focused on were the role of bats in rabies transmission, what vampire bats diet actually consists of, the agricultural contribution of bats, the taxonomic

classification of bats, the increasing numbers of bats becoming endangered due to White-nose syndrome, wind turbine technology and habitat destruction, and the benefits of human cooperation with building bat houses and protecting cave sites. The presentation also strongly emphasized the average sizes of differing species of bats, what bats are likely to be seen in Florida, all of the environmental, financial, and health contributions that bats have produced, what to do if a stray bat is found, and how bats are being threatened. All educational sessions had time for participants to ask questions.

In order to compute my data, I considered seven different dependent variables. The first two questions (DV1 and DV2) were rated on scale of 1-5, the next 5 true or false questions (DV 3) were combined for a total score ranging from 0-5, and the last four (DV 4-7) were on a scale of 1-5. Each post DV score was compared to its pre-score to determine whether there were any significant changes. One way ANOVAs and t tests were run to determine if any significant changes occurred between the three conditions or from pre-to post tests in the individual conditions.

# RESULTS

## Analysis of Change in Overall Feelings between the Three Conditions

A one-way ANOVA was run to determine if there were any significant differences between the three different conditions (i.e., "base", "taxidermy" and "live") in terms of change in overall feelings towards bats ($F(2, 87)=4.45$, $p=.014$). Post-hoc tests (Tukey HSD) showed that the mean change score for the "base" condition ($M=.64$, $SD=.59$) was significantly different from the mean change score for the "taxidermy" condition ($M=1.16$, $SD=.77$), $p=.03$, and from the mean change score for the "live" condition ($M=1.06$, $SD=.80$), $p=.04$. However, the difference between the mean change scores for the "taxidermy" and "live" conditions was not significant, $p=.88$.

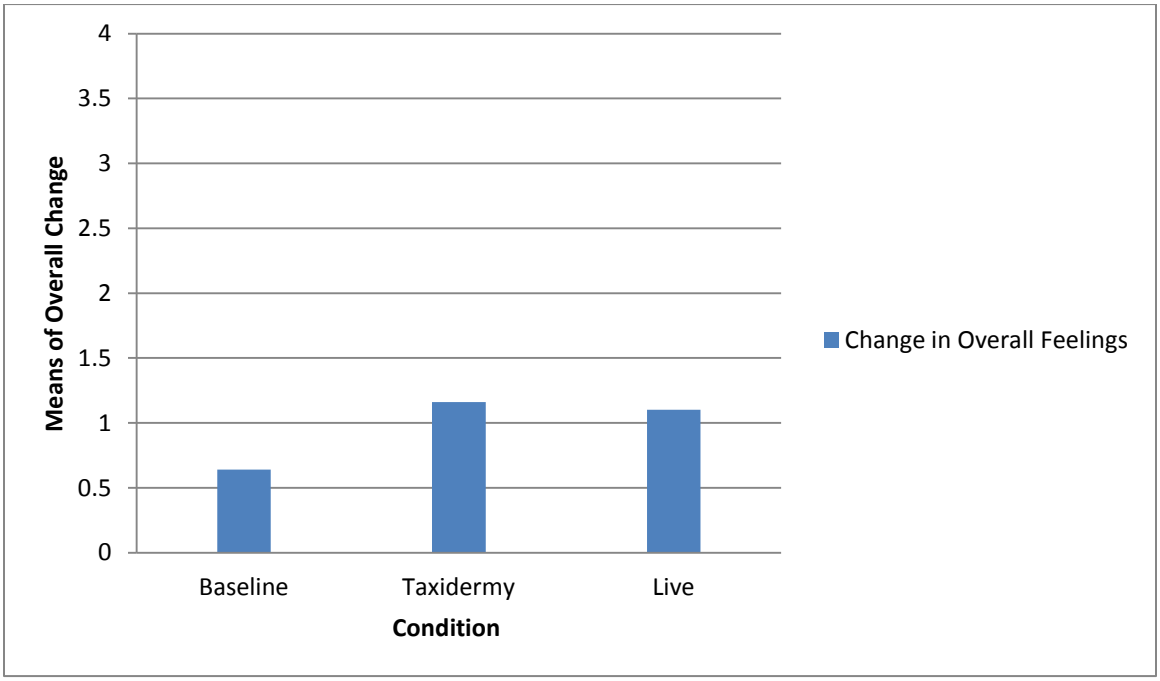



Figure 1: This depicts the change in overall feelings towards bats among the three levels

**Analysis of Change in Feelings of Bats being Beneficial to the Environment between the Three Conditions**

A one-way ANOVA was run to determine if there were any significant differences between the same three conditions in terms of change in overall feelings regarding bats being beneficial to the environment ($F(2,87)=3.15$, $p=.048$). Post-hoc tests (Tukey HSD) showed that the mean change score for the "base" condition ($M=.69$, $SD=.69$) and the mean change score for the "live" condition ($M=1.11$, $SD=.93$) approached being significantly different ($p=.053$). The mean change score for the "base" condition was not significantly different from the "taxidermy" condition ($M=.74$, $SD=.45$) $p=.978$. Also, the "taxidermy" and "live" conditions were not significantly different, $p=.187$.

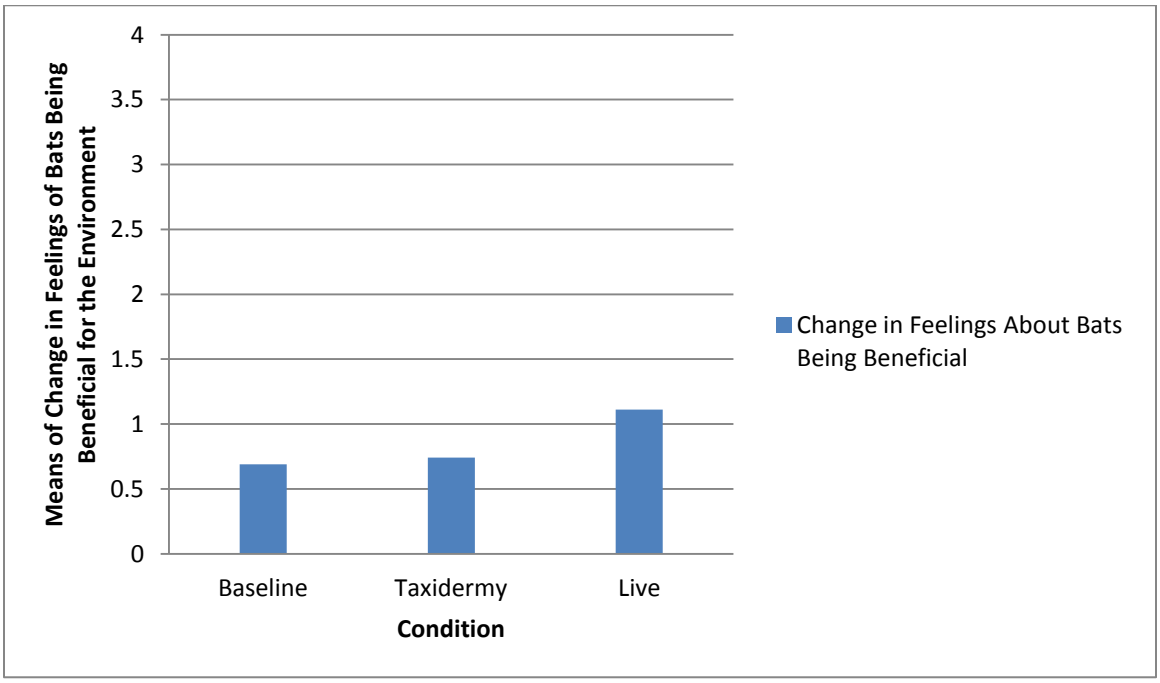



Figure 2: This depicts the change in feelings about bats being beneficial among the three levels

**Analysis of Initial Overall Feelings between the Three Conditions**

A one-way ANOVA was run to determine if there were any differences between the initial feelings in the three different conditions ($F(2,87)= 6.36$, $p=.003$). Post-hoc tests (Tukey HSD) showed that the "base" condition ($M=3.53$, $SD=.77$) was significantly different from the "taxidermy" condition ($M=2.74$, $SD=.81$) $p=.003$ and approached being significantly different from the "live" condition ($M=3.09$, $SD=.85$) $p=.06$. The "taxidermy" condition ($M=2.74$, $SD=.81$) was not significantly different from the "live" condition ($M=3.09$, $SD=.85$) $p=.29$.

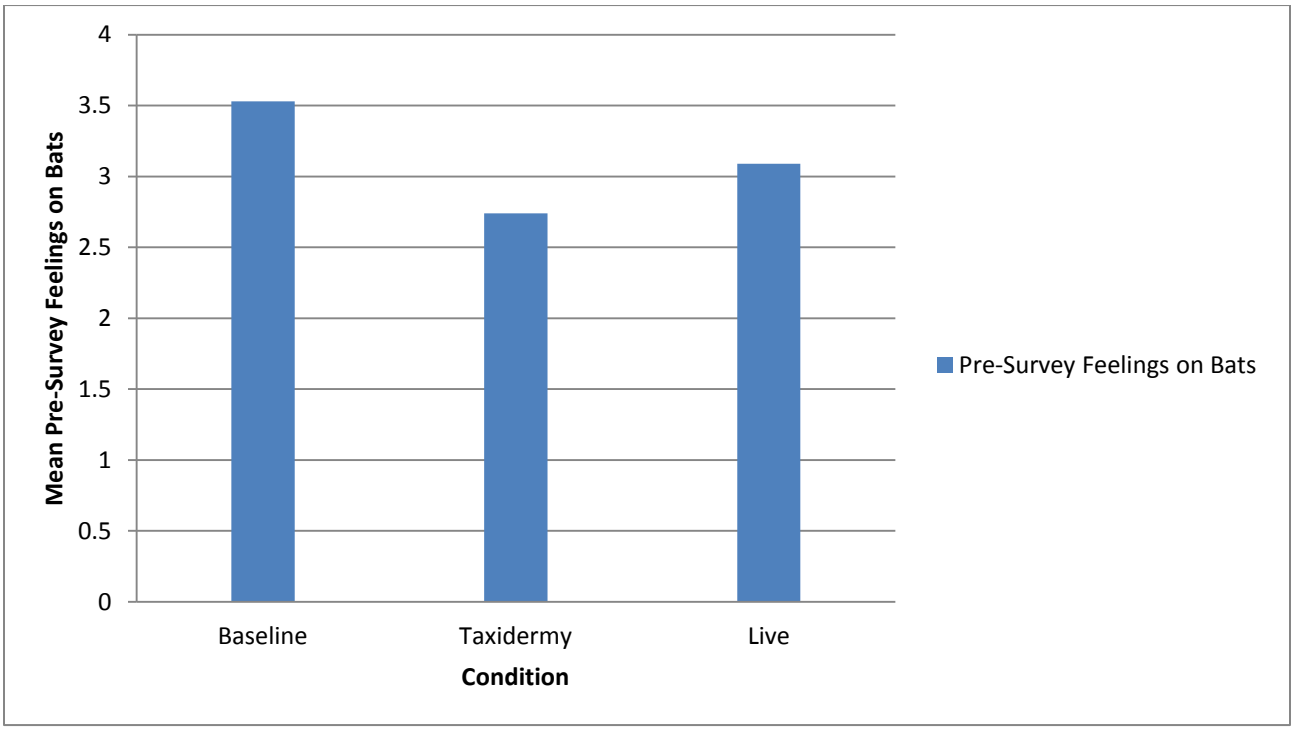



Figure 3: This graph shows the mean feelings on bats for the pre survey, before participation in the experiment.

**Analysis of Change from Pre- to Post Test for Overall Feelings**

One-sample t tests were run to determine if there were any significant changes in the overall feelings from pre-to post-test among the individual conditions. In the "base" condition, the mean difference (*M*=.64, *SD*=.59) was significantly higher than zero, t(35)=6.47, p<.001, which indicated a positive change from pre- to post-test. In the "taxidermy" condition, the mean difference (*M*=1.16, *SD*=.77) was significantly higher than zero, t(18)= 6.60, p< .001 which indicated a positive change from pre- to posttest. In the "live' condition, the mean difference (*M*=1.06, *SD*=.80*)* was significantly higher than zero, t(34) = 7.80, p<.001, which indicated a positive change from pre- to posttest.

**Analysis of Change from Pre- to Post Test on Feelings of Bats being Beneficial to the Environment**

A one-sample t-test was run to determine if there were any significant differences between the pre and post changes in the feelings towards bats being beneficial to the environment. In the "base" condition, the mean difference (*M*= .69, *SD*=.69) was significantly higher than zero, t(35)= 6.23, p<.001, which indicated a positive change from pre- to posttest. In the "taxidermy" condition, the mean difference (*M*= .74, *SD*= .45) was significantly higher than zero, t(18)= 7.10, p<.001, which indicated a positive change from pre- to posttest. In the "live" condition, the mean difference (*M*=1.11, *SD*=.93) was significantly higher than zero, t(34)= 7.10, p<.001, which indicated a positive change from pre- to posttest.

Analyses for all of the other DVs were run, and it was found that the participants significantly changed in terms of their knowledge about bats in all conditions, but the conditions did not differ significantly from each other.

# DISCUSSION

I hypothesized that any exposure to educational information about bats would cause some degree of change in perception, but that the highest level of interaction would cause the best retention of knowledge and the highest degree of change in perception. The results of the comparison of overall feeling change toward bats between the three conditions shows that the mean difference for the taxidermy condition was significantly higher than the mean difference for the baseline condition. This is consistent with my hypothesis in that a higher level of interaction did cause a higher degree of attitude change; however, there was no significant difference in attitude change between the taxidermy condition and the live bat condition. This is not completely consistent with my hypothesis, because only the taxidermy bat produced a change in attitude, while the live bat did not produce any significant changes in attitude. However, the fact that there was any change at all from the baseline condition to the taxidermy condition still supports the idea that higher levels of interaction *do* influence perception. In this experiment, the level of interaction was not as high as it could have been, because the bat had to remain in her cage for safety and health concerns. The second analysis comparing the change between the three conditions on the participants' feelings about bats being beneficial to the environment showed that there was a significant change from the baseline participants to the live participants, but not a significant change between the baseline participants and the taxidermy participants. This does support my hypothesis, because the taxidermy condition did not render the significant change in opinion that the live bat did. Although there was a slight change from the baseline to the taxidermy condition, it was not significant. Both of these variables were also compared using

a t test, and for the overall feelings as well as for the feelings about bats being beneficial to the environment, there were significant changes from the pre survey to the post survey across the board. The t test shows the mean change scores from pre to post, but still demonstrates that the taxidermy condition had a higher rate of perceptual change than the base group. Although the results did not show that a higher degree of learning occurred from one level to another, all of the levels had a significant degree of change. This supports my hypothesis that any exposure to information will cause a perceptual change and a change in factual knowledge, but the support is limited to feelings about the bat's impact on the environment, and not necessarily personal feelings. It is important to note that the significant differences observed were seen after a relatively weak manipulation of the independent variable. The taxidermy bat was very similar to the live bat (in that participants could not interact with the live bat, so all they could do was observe it) and both the taxidermy bat and live bat were a small addition to the educational presentation. It seems that although the participants clearly learned information they were unaware of prior to the study, this exposure to the independent variable could cause them to change their minds about how beneficial bats are, but not necessarily how they personally feel about them. Although individual opinions did change (and the majority of opinions shifted from "neutral" to "positive"), having an intermediate level of interaction was about the same as having the highest level of interaction in terms of causing people to change their feelings towards bats. Throughout the study, it seemed that most participants came in with very little knowledge about bats and left with a much more positive, balanced view of their contributions to the environment.

An important factor to consider when reading the results of this experiment in regard to the overall attitude change is that the initial pretest surveys showed that there was a difference in

the overall feelings between the groups before the experiment started. The baseline mean was significantly higher than the live mean, which was significantly higher than the taxidermy mean. The taxidermy group started with the lowest mean and had the most significant mean difference between the groups in the change in overall feelings. This implies that because the baseline group started with a more positive perception of the bats, there was less room for change than the taxidermy or live group.

In each condition, the ratio of women to men was skewed in that women always outnumbered men, but in the live condition, the ratio was almost even compared to the taxidermy group, which had 4 men and 16 women. This disparity between gender distributions could account for some of the results found in the live group, because the taxidermy group had a significant feeling change while the live group did not, and perhaps this is because women were affected more than men, and this was not balanced in the taxidermy group. If there was a difference in the way that males and females changed their perceptions in response to the presentation, that may have been reflected in the taxidermy group because there were more females.

Also, it is possible that because the live bat could only be viewed and not interacted with, the difference between the taxidermy bat and the live bat was not enough. However, the live bat did cause a difference in the live group viewing bats as being more beneficial to the environment.

In order to ensure that the questionnaire would represent the information that would typically be presented by the City Bat Conservancy presentations, I made the questions

moderately challenging instead of difficult. If I had chosen to make the surveys more difficult, it would not have appropriately reflected the style of the Conservancy presentations, and would then make the results less generalizeable. However, this may account for there being no statistical differences between the learning that occurred across the three groups because if the questions were too easy, the means of measuring statistically significant differences may not have been sensitive enough to determine if factual learning was any different across the groups. [1]

Additionally, the taxidermy group had fewer participants than the other two groups. Having a smaller group participate in the study could have made them feel as if they had a more intimate learning experience, which could have caused them to pay more attention, and therefore have a higher degree of change in attitudes.

For this experiment, the pool of participants came from students who were enrolled in at least one psychology class. The only restriction outside of that was that participants be over the age of 18. This sample does not necessarily represent those that would attend a zoo, or any other educational lecture (there would most likely be a greater deal of diversity between age groups), so results may differ if a more diverse group is used. Some of the participants for this experiment paid less attention to the presentation, or were disinterested. This type of presentation would often be given at an environmental center or at a zoo. A different group of patrons would be attracted at a zoo or environmental reserve, perhaps people who have a genuine love of animals or have a desire to change environmental problems in the community. For this experiment, the

[1] Analyses of the pre-test and post-test knowledge scores did suggest a possibility of ceiling effects.

students were there to fulfill a requirement for class or to receive extra credit. If a group is more enthusiastic about the bats, a higher degree of attitude change may be seen.

Additionally, if there is a wider age span, there may be more significant differences in the retention of the information presented in the lecture. The retention of a child when presented with a live animal and a significant amount of information may be very different from that of an adult over the age of 65. Groups of visitors that come to zoos or theme parks together often have a wide span of age ranges present in the group (a mother, grandmother and a child). Groups that are composed of these age ranges may be more representative of the population that would attend a presentation at the zoo or Conservancy.

Future studies potentially should have another level with a fruit bat present. Fruit bats are often looked at as the "cuter" or "more approachable" species and it would be interesting to compare the microchiroptera (smaller, insectivorous bats that are found in Central America) live condition that I used in my experiment to a megachiroptera condition (larger Old World fruit bats) and see if the physical quality of the bats would influence participants' attitude towards them. I would hypothesize that participants would have a significantly more positive attitude towards fruit bats than the microchiroptera used in my experiment. Although it would have been interesting to see massive differences between the taxidermy condition and the live bat condition, the experiment shows that any interaction counts, and additionally, that a higher degree of interaction does cause some change. Having the live bat present coincided with participants being more understanding of the positive impact of bats on the environment (which is a key step

in participants changing their negative perceptions about bats), so the presence of the live bat actually did have a positive influence on at least one of the variables.

The results from this experiment lead to the conclusion that the general population does have a lot to learn about bats, and regardless of the amount of interaction, presenting the factual information does help make a difference. Having an intermediate level of interaction supports attitude change and has great implications for what educational facilities can do with their programs. The news that something as small as a taxidermy animal being present could change the way people view bats is great news for zoos and other facilities because a taxidermy animal is extremely cost effective, and does not require any actual care. Transportation is much easier and approval is not required to bring a taxidermy animal into a building or campus.

Depending on what the goal of the facility is, different factors can be included in presentations to achieve the best result for the facility. Feelings about bats making environmental contributions and emotions regarding bats were influenced differently depending on the level of interaction. If what the facility wants is to change people's feelings about bats, they can use a taxidermy bat and know that it will contribute to feeling change. However, if the facility wants to actually see a difference in the application of thinking that bats are beneficial to the environment, a live bat is a more reliable means of ensuring that the attitude change occurs.

Educational facilities and programs can be comforted in knowing that their presentations are making a difference and that facilities such as the Conservancy are moving in the right direction using these interactive measures to support their messages. Facilities could strive to

make their exhibits more interactive, and investigate the effects of more intimate interactions with the desired animal.

This research is applicable to many other stimuli, including other animals that are viewed in a negative light. Additionally, this information can be applied to any educational setting. Programs such as sexual education deal with informing a population about little known statistics and striving to educate others in order to promote safer practices. This, in its goal, is very similar to the educational presentation that I created and could take from my experiment the idea that educational presentations are effective, and interaction (in moderation) is a positive influence on perceptual change and educational retention.

# APPENDIX A: IRB APPROVAL LETTER

# APPENDIX A: IRB APPROVAL LETTER

University of Central Florida

University of Central Florida Institutional Review Board
Office of Research & Commercialization
12201 Research Parkway, Suite 501
Orlando, Florida 32826-3246
Telephone: 407-823-2901 or 407-882-2276
www.research.ucf.edu/compliance/irb.html

## Approval of Exempt Human Research

From: **UCF Institutional Review Board #1**
**FWA00000351, IRB00001138**

To: **Matthew G. Chin** and Co-PI: **Samantha Hynes**

Date: **October 11, 2012**

Dear Researcher:

On 10/11/2012, the IRB approved the following activity as human participant research that is exempt from regulation:

| | |
|---|---|
| Type of Review: | Exempt Determination |
| Project Title: | Influencing Opinions About Bats: The Impact of Levels of Interaction During Educational Presentations |
| Investigator: | Matthew G. Chin |
| IRB Number: | SBE-12-08732 |
| Funding Agency: | |
| Grant Title: | |
| Research ID: | NA |

This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are made and there are questions about whether these changes affect the exempt status of the human research, please contact the IRB. When you have completed your research, please submit a Study Closure request in iRIS so that IRB records will be accurate.

In the conduct of this research, you are responsible to follow the requirements of the Investigator Manual.

On behalf of Sophia Dziegielewski, Ph.D., L.C.S.W., UCF IRB Chair, this letter is signed by:

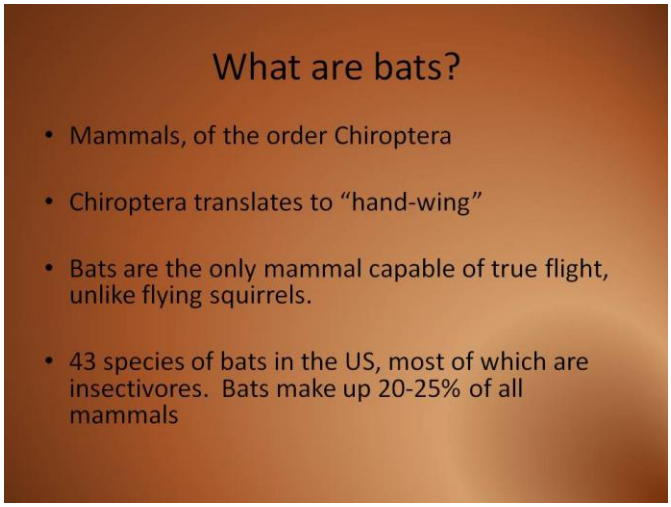
Signature applied by Joanne Muratori on 10/11/2012 03:33:22 PM EDT

IRB Coordinator

Page 1 of 1

## APPENDIX B: BAT PRESENTATION SLIDES

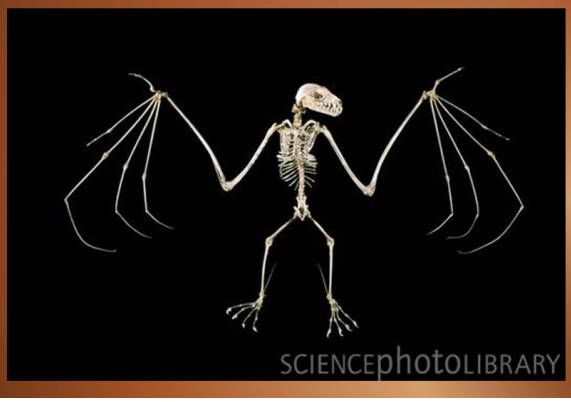
## APPENDIX B: BAT PRESENTATION SLIDES

## What do you already know about bats?

- Commons myths:
- Vampire bats attack humans and are dangerous
- Most bats carry rabies
- Bats often get tangled in your hair
- Bats are rodents
- Bats are blind

## "Hand-Wing"




## Suborders

- Megachiroptera vs Microchiroptera
- Most US bats are microchiroptera (insectivorous, echolocating bats), which range from 2-5 inches in body height. (About the size of a thumb, or small phone)
- Megachiropter are fruigivorous and do not use echolocation. They can grow up to 16 in tall, and have a wingspan of 5.6 ft.

**Smallest bat**

Kitti's hog-nosed bat, AKA: bumblebee bat, comparable to a penny

## Largest bat: Flying fox

## Dispelling Myths

- Vampire bats: Range from Central to South America. About the size of a small phone, anti-social, pray on livestock. Vampire bats lap blood from an incision that they make using their incisor teeth. They prey primarily on sleeping animals, using an anti-coagulant found in their saliva. Usually, this feeding goes on unbeknownst to the host.
- Vampire bats are one of the only species of bats known to actually adopt another bat's pup if something happens to the mother

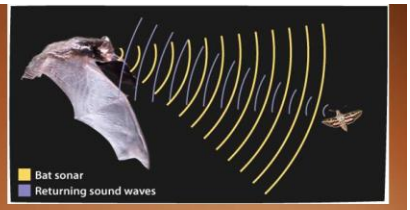
## Dispelling Myths

- Rabies: Rabies IS contractible from bats, but it is not common.
- There is a better chance of being struck by lightening than there is of coming into contact with a bat who has rabies. Statistically speaking, less than ½ of 1% of bats have rabies.
- Bats are not carriers, they typically die quickly after infection
- Warning: Bats that are found on the ground should never be handled directly. If they're close enough to socialize with humans, something may be wrong with them.

## Dispelling Myths

- Bats do not consistently get tangled in people's hair. Mosquitoes are often found around humans, and micro bat's primary diet consists of mosquitoes and other bugs. The bats are more interested in your mosquitoes than your hair.
- Bats are not blind. They have decent vision, but microbats use echolocation for hunting because it is extremely accurate

## Echolocation




- Bats generate a sound from their larynx, which returns back to the bat as an echo after it bounces off the surrounding objects. This echo tells the bat (who has specialized ears to receive the echo) exactly what they're hunting, where it is, and how fast it is.
- With echolocation, bats can detect something as small as a single strand of human hair, or a fin protruding only 2 mm above a surface

## Bat Benefits

- In Arizona, bats pollinate cacti, which supports the dessert ecosystem.
- Bats pollinate plants in the rainforest that allows the rainforest to survive,

making bats a "keystone" species

- Bats pollinate agave, coconut, bananas, avocados and cocoa plants.
- Medical contributions (saliva)
- Guano production

## Bat Benefits


- A single bat can eat 600-1200 mosquitoes in an hour. They feed 6-8 hours a night.

This is the equivalent of us eating 40 pizzas in one sitting.

- Western Farm Press (2011) estimates that bats are responsible for saving upwards of at least $3 billion dollars a year in pest control taxes for the agricultural industry.
- Due to one million bats dying from White Nose Syndrome (1/6$^{th}$ of the estimated impact) Western Farm Press (2011) estimated that 660-1320 metric tons of insects are no longer being consumed by bats

## Florida Bats

- Most Florida bats are tree bats, meaning they are solitary (not colonial)

Eastern Red Bat
Northern Yellow Bat
Seminole Bat
Hoary Bat
Big Brown Bat (2.5 in) (colonial)
Eastern Pipistrelle (1 ¾ in) (9 in wingspan)
Southeastern Myotis (cave dwelling, mosquitoe eater)
Rafinesque Big Eared Bat
Gray Bat
Florida Bonneted Bat (colonial: million bat colonies)
Velvety Free-tailed bat
Brazilian Free-tailed bat (1 of 2 most commonly seen in bat houses)
Evening Bat (2$^{nd}$ most commonly seen in bat houses)


## Threats

- White-Nose Syndrome: 6.7 million estimated
- Habitat destruction
- Intentional removal and destruction of maternity colonies
- Human hunted
- Pesticides
- Windmills

## Why are bats threatened?

- Bats are extremely slow to reproduce.

Much like humans, they only have one or two pups a year.

- Bats sometimes form maternity colonies made of entirely females and pups. These used to be commonly destroyed, but now there are laws protecting the disturbance

## What can you do?

- Build/ buy a bat house
- Don't get rid of your dead trees. These are magnificent houses for bats. Dead cypress, pine, palm and oak trees are all ideal habitats for bats.
- Don't go to caves where bats live
- Reduce pesticide use
- Educate others

## Bat houses

- Must be narrow, air tight at the top, and have a slot towards the bottom for ventilation. 12-15 ft off the ground, 6-8 hours of direct sunlight.
- Can fit 3-400 bats/ per bat house

## FAQ'S

- Bats have been around for over 50 million years
- Bats are more closely related to primates than rodents
- Baby season is April-May, and bats can be nursed as short as 2 weeks or as long as 3 months
- Bats can live 20-30 years
- Bats can not take flight from the ground, they must "fall out" to take off.
- Bat species are quickly becoming endangered due to the environmental threats they face

## What to do if you find a stray bat

- Call your nearest bat rehab or animal control
- Never handle directly with bare hands
- Put the bat back in your bat house if he has fallen out.
- Bats are excellent climbers, and if given a stick can often maneuver their way back into the bat house with minimal help.

# REFERENCES


Anderson, U.S., Kelling, A.S., Pressley-Keough, R., Bloomsmith, M.A., & Maple, T.L. (2003). Enhancing the zoo visitor's experience by public animal training and oral interpretation at an otter exhibit. *Environment and Behavior 35*(6), 826-841. doi 10.1177/0013916503254746

Batting In Ohio, Evening Bat. Image. Retrieved November 19th 2012 from: http://lh3.google.com/rvtyme/RuWVodVEZ1I/AAAAAAAABQI/lAcsSh0-CFM/s288/%5C%5CShelsvr%5CUserDocuments%5CJJohnson%5CMy%20Documents%5CMy%20Pictures%5CBats%5CIndiana%20Bat%201.jpg

Bats save U.S. agriculture billions in pest control. (2011, April 1). *Western Farm Press* [Online Exclusive]. Retrieved from http://go.galegroup.com.ezproxy.lib.ucf.edu/ps/i.do?id=GALE%7CA253030755&v=2.1&u=orla57816&it=r&p=PPAG&sw=w

Costa, M. L., van Rensburg, L., & Rushton, N. (2007). Does teaching style matter? A randomized trial of group discussion versus lectures in orthopedic undergraduate teaching. *Medical Education*, *41*(2), 214-217. doi:10.1111/j.1365-2929.2006.02677.x

Furey, N. M., Mackie, I. J., & Racey, P. A. (2011). Reproductive phenology of bat assemblages in Vietnamese karst and its conservation implications. *Acta Chiropterologica, 13*(2), 341-354. doi: http://dx.doi.org/10.3161/150811011X62481

Lindemann-Matthies, P., & Kamer, T. (2005). The influence of an interactive educational approach on visitors' learning in a Swiss zoo. *Science Education, 90*(2), 296-315. *doi:*10.1002/sce.20127

Ochoa, J. G., & Wludyka, P. (2008). Randomized comparison between traditional and traditional plus interactive Web-based methods for teaching seizure disorders. *Teaching and Learning in Medicine, 20*(2), 114-117. doi:10.1080/10401330801989513

Shams, L., & Seitz, A. R. (2008). Benefits of multisensory learning. *Trends in Cognitive Sciences, 12*(11), 411-417. doi:10.1016/j.tics.2008.07.006

Swanagan, J. S. (2000). Factors influencing zoo visitors' conservation attitudes and behavior. *The Journal of Environmental Education, 31*(4), 26-31. doi:10.1080/00958960009598648

Tausch, N., & Hewstone, M. (2010). Social dominance orientation attenuates stereotype change in the face of disconfirming information. *Social Psychology, 41*(3), 169-176. doi:10.1027/1864-9335/a00002

Woodruff, K., Ferguson, H. (2005). Townsend's Big-Eared Bat. (2012, November 6) *Washington Department of Fish and Wildlife.* Retrieved from http://wdfw.wa.gov/publications/00027/toba.pdf

White-Nose Syndrome: A Crisis for America's Bats. (2012, June 14). *Bat Conservation International.* Retrieved from http://www.batcon.org/pdfs/whitenose/WNS_FAQ.pdf

Wishart, J., & Triggs, P. (2010). MuseumScouts: Exploring how schools, museums and interactive technologies can work together to support learning. *Computers & Education*, *54*(3), 669-678. doi:10.1016/j.compedu.2009.08.034

Zebrowitz, L. A., White, B., & Wieneke, K. (2008). Mere exposure and racial prejudice: Exposure to other-race faces increases liking for strangers of that race. *Social Cognition*, *26*(3), 259-275. doi:10.1521/soco.2008.26.3.259