FROM PAGES TO PLACES: SITUATING KELLY ET AL.'S THE ROBOT ZOO: A MECHANICAL GUIDE TO THE WAY ANIMALS IN WORK IN REAL-LIFE CONTEXT

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The Supervisory Committee certifies that this ***disquisition*** complies with North Dakota State University's regulations and meets the accepted standards for the degree of

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ABSTRACT

The Robot Zoo: A Mechanical Guide to the Way Animals Work (1994), written by John Kelly, Dr. Philip Whitfield and Obin, consists of textual descriptions and visual images of sixteen robot animals. Among them, my discussion of Giraffe, Platypus and Rhino highlights the fact that they are endangered animals who are facing extinction due to climate change, human encroachment, poaching, illegal trade, and a lack of biodiversity. Although my other subjects of discussion such as House Fly, Grasshopper, Chameleon and Bat do not necessarily face any immediate extinction, this paper shows how scientists are using the heights and zips of these flying beings for wildlife conservation and construction engineering, even raising the possibilities of conserving real-life giraffes, rhinos, and platypuses. Therefore, in my paper, I prove that the more people watch and interact with electronic animatrons on display in robot zoo exhibitions, the more informed they will be about conservation, extinction, and the global climate crisis.

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Finally, I dedicate this paper to my wife/best friend/colleague, Jainab Tabassum Banu (Sonali), and our son, Mahbub Ul Wadud Alam (Shreshtha), and daughters, Rahela Tabassum Alam (Surela) & Aparajita Tabassum Alam. (Olivia). Thank you for loving me, tolerating me, and keeping me in your abode. I love you the most.

To the people of Bangladesh, I will return home to serve you. Please hold me in your heart. And Fargo will remain in my heart forever. Remember me.

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INTRODUCTION

The Robot Zoo: A Mechanical Guide to the Way Animals Work, written by John Kelly, Dr. Philip Whitfield, and Obin was published in 1994, the same year when The Internet" was popularized and made its way into the popular imagination. In the mid-nineties, people began to learn the use of email (Bort) and would have preserved data using floppy disks. When the word "internet" flowed across the market, humans did not know what to say and how to react to it. A YouTube clip from 1994 shows three television hosts explaining how perplexed they were about the new arrival of the word called the "Internet" (Miklacic). Likewise, in David Letterman's 1995 show, the host Letterman asks Bill Gates: "What about this internet thing? Do you know anything about that?" Then, Bill Gates calls it "the big new thing" (3:10-3:28).

Beyond the popular media, scholarly articles published in 1994 and 1995 focused on defining the internet and its workability. For example, Tricia Henry, in her 1994 article discusses how email communication helps her in sending quick announcements and using library databases for online reading materials on dancing (56-8). She urges her readers to "find out about the internet, get a modem, get on the network" (58). Likewise, Henry and Pallen state that the internet requires computers, "a set of rules of protocols governing the exchange of information between computers" and a modem (1422 &1424). Even in my household in Bangladesh, a country of the global south, the Internet held an aura. For example, my father bought our first modem for connecting us to the internet in nineteen ninety-eight, when I was eleven years old. My near and extended family members were equally curious, as I see in Henry and Pallen about the internet. After using it, I discovered in nineteen ninety-nine that it was a gateway for me to connect to the entire world through search options. Although the Internet was at its earliest stage in 1994/5, critics, who have been cited here, concur that the Internet, either good or bad, brings a sense of excitement, mystery, and inscrutability around it.

Starting in 1994, the rapid expansion of the Internet encouraged scientists to share their lab findings with global communities through virtual communication (Anderson 900). In 1990, in an interview, critic Donna Haraway disagreed with the perception that technology ruins the world. Instead, she encourages the positive and playful use of technoscience innovations to contest “inequality and arbitrary authority” (Penley et al. 13). In *The Companion Species Manifesto*, Haraway argues that human and nonhuman species should be the focus of technoscience studies (4). For writing the book, she chooses dogs to be her subject matter to draw equal attention to the discourse on nonhumans and shower hope on human-nonhuman relationships (4). In “The Cyborg Manifesto,” Haraway says, “The machine is not an it to be animated, worshipped, and dominated. The machine is us, our processes, an aspect of our embodiment” (181). Therefore, humans and nonhumans can form strong partnerships together to create instrumental knowledge to bring equity and a plurality of thoughts.

Echoing Haraway’s sentiment, I write this paper on *The Robot Zoo* to explain how the book’s manuals of animatronic animals have been used in exhibitions and scientific discoveries to disseminate information about the way animals such as Giraffe, Rhinos, and Platypus live and work. Likewise, I discuss *The Robot Zoo* not to argue that it should be either worshipped or dominated. Instead, I ask the stakeholders concerned, such as the Fargo Moorhead community, to establish new robot animal zoos to encourage children and young adults to visit them all throughout the year.

What is a robot zoo/museum? A robot zoo is like a real-life animal zoo. It displays animals, closely/loosely mimicking the wild-life animals. Since the Fargo-Moorhead area is scorchingly hot in the summer and freezingly cold in the winter, I would request the authority to establish a building with full amenities which should be fully dedicated to the displaying of robot zoo animals: giraffe, platypus, rhinos, bat, house fly, chameleon, and grasshopper; all should be electronically charged. Furthermore, that place may have categories of different spots and plaques carrying information about exhibited robots. For example, visitors, before watching a robot giraffe in the museum, may read about the robot giraffe from the plaque/information booth. The stakeholders concerned may find information about the above-mentioned robot animals in John Kelly et al.'s *The Robot Zoo.*

My discussion of Chapter 1 proves that children, young and ageing adults love going to the robot zoo. I chose Kelly et al.'s *The Robot* Zoo as my primary text because I observed in 2023 that the book has not received its due attention despite the massive amount of potential it has to bring to the conversation about human-animal relations. Knowing that *The Robot Zoo* does not have any critical work on it did in fact encourage me on to dissect the book and unearth its inner meanings with my scholarly endeavor and fresh perspectives. Beyond this Introduction, I divided my analysis into Five Chapters.

Chapter 1, titled "The Robot Zoo Exhibitions"discusses how museum and exhibition owners use the concept of the book to arrange attractive events for children, young and ageing adults to encourage them to watch and learn about robots and living animals. Based on critic George Bodmer's questions on how to analyze a text visually, Chapter Two ruminates on the visual components of *TRZ.* I discuss seven robot animals in Chapter III and Four. However, I separate out land and water animals from flying animals. Therefore, the land mammals that I chose from *TRZ* for discussing Chapter Three are Giraffe and Rhinos and the only water animal for my analysis of Chapter Three is platypus. I show that Giraffes, Rhinoceroses, and Platypuses are going extinct. Displaying their electronic animatronic versions can effectively raise awareness about the sixth mass extinction and the human-dominated world, while also being instrumental to human knowledge about the animal kingdom among young and aging adults.

TRZ does not illustrate the pictures of land and water mammals only. Chapter Four discusses some of the amphibian animals featured in the book. For this section, I have focused on House Fly, Chameleon, Grasshopper and Bat because these flying beings do not always receive as much attention but are instrumental to the development and perfection of robotics, raising awareness about animal testing and the potential suffering therein. Scientists have been trying to innovate different patterns of flying objects based on House Fly, Chameleon, Grasshopper and Bat to build roads and spread insightful information about wildlife.

In recent years, robot zoo exhibits, largely based on the concept of Kelly et al.'s TRZ, are taking place across America. Likewise, ExplorationWorks, an organization, which was inaugurated in 2007 to improve children's and their family members' fascination with science, debuted the exhibition of The Robot Zoo in Helena, Montana in May 2023. The South Florida Fair exhibited animatronic rhinos, a platypus, a housefly, a wingspan, and a giant squid in January 2022 (Valys). The SXSW Zoo inaugurated a "robot petting zoo" in 2015 to show that robots are not fearsome; they can help in national disaster relief efforts, too. A part of the latter exhibit, a tiny robot named BlabDroid, which has "bulldozer wheels, a cardboard body and a smile on his face," is described as a sweet but tough questioner. Scientists made BlabDroid small because they did not want visitors to have the fear of a gigantic robot asking random open-ended questions (Sydell). There is this other one called Ozobot which is made to help kids learn the basic structure of programming (Sydell).

Most of the exhibitions and museums use eight common animals based on real-life animals. In order to keep the breadth and space of this paper manageable, I will analyze seven of the sixteen animals featured in the book. The reason for choosing a chameleon, a rhinoceros, a platypus, a bat, a grasshopper, a housefly, and a giraffe is that all of them have been included in "robot zoo" museum exhibitions in the U.S., specifically: ExplorationWorks, Evergreen Exhibitions and the SXSW "robot petting zoo." Most of my contextualized reading on robot animals is derived from library databases, newspaper articles, digital platforms, and official websites of exhibitions.

Since many animals and insects are losing their habitat, the concept of robot zoo animals, in my opinion, will be growing more popular in the days to come. My attempt to work on this book is to show that there are serious environmental concerns and loss of human numbers caused by deforestation and abuse of nonhuman animals. I understand the reality that many animals are long gone; they cannot be brought back to life. For example, African Bluebuck went extinct in the nineteenth century (Jørgensen 321). Therefore, I would suggest the recreation of African Bluebuck in the robotic form. If children, young and aging adults watch one robot Bluebuck as a machine in an exhibition, they will find more curiosity to know why that animal lost their place in the world, and what they might want to do for not allowing the same pattern to be repeated.

The use of robot animals may reduce the use of taxidermy on animals. Many find it to be a cruel practice. However, people also support the use of taxidermy. For instance, Heather Cammarata-Seale praises artist Petah Coyne for using a taxidermized feline "to embody a human alter ego" (13) and "bring awareness to the animal otherness within humans" (13). She does not write about the cruel practices of taxidermy, unlike Giovanny Aloi, who opines that taxidermized animals evoke the human desire to "construct nature," objectify nonhuman animals, and establish the Anthropocene without ethical considerations (102). Instead of promoting the use of taxidermized animals, or killing them for room decorations, it will be better for wild-life and the environment if humans promote the usage of robot animals for displays and exhibitions.

Using robot animals on display, in museums and for scientific inventions does not require any drop of bloodshed and loss of living beings. That is why Kelly et al.'s *TRZ* acts as a guide to inform children, young and ageing adults about how mechanized nonhumans are useful for them to recreate robot exhibitions without harming any living body and the environment. With that perspective in mind, my thesis "From Pages to Places: Situating Kelly et Al.'s *The Robot Zoo in Real-Life Context"* discusses seven robot animals from *TRZ* to create awareness about real-life animal plight and develop a conciliatory approach towards nature and wildlife with the belief that expansion of cyborgs is good for gaining more insights about the animal world.

CHAPTER 1: THE ROBOT ZOO EXHIBITIONS

In *TRZ,* the authors' rhetorical position is that the robot zoo animals inform humans about living nonhuman animals. From that perspective, they draw playful images of robot animals and use texts to describe how readers and viewers may learn more about living nonhuman animals. Although the book was published in 1994, the first recorded robot animal display based on the book was held only four years after the publication of *The Robot Zoo.* Also, the book was gathering traction in regional newspaper outlets in the same year. For example, on 14 April 1998, a newspaper article titled "Robot Zoo" in *The Chicago Tribune* informed readers about the inauguration of the first-ever Robot Zoo, which not only traveled across America but also allowed visitors to play games with the electronic zoo animals (9). Furthermore, Silicon Graphics and TIME magazine co-sponsored "The Robot Zoo" to show children "a cast of dynamic, mechanical animals" with hopes that they would stir their imagination and create interest in science & technology ("Silicon Valley, Time Sponsor, The Robot Zoo").

One of the animal handlers and Evergreen Exhibitions' subcontractors Greg Bear cites John Kelly et al.'s *The Robot Zoo* as the inspiration behind the establishment of the robot zoo. He informs that children's interaction with the robot zoo animals was the "most fun part" of the exhibitions. Moreover, another technician named Doug Rucker thinks that children enjoy being in robot zoos because they can touch the animals and communicate with them on their own terms. Bear asks viewers to "read the book" because "the book is really cool" (Gail Borden Public Library). Both Bear and Rucker invite visitors to the exhibition because of its fun, family-friendly environment that the exhibitions are not only entertaining, but they also teach biomechanics (Gail Borden Public Library). The context shows how the features of robot animals bring out positive emotions in human beings.

A similar robot zoo exhibit was housed at the Sloan Museum Robot Zoo at Courtland Center, Burton, and it featured the robot giraffe exactly shaped as the cover page of John Kelly's et al.'s *The Robot Zoo*. In a video recording promoting the exhibit, the narrator explains that children can press different buttons and see a) how the robot grasshopper moves its parts and plays hide-and-seek and b) alters its color. Visitors can use the joystick to move the chameleon's head either left or right. Out of the chameleon's tongue, they introduce a game called "tongue gun". The tongue is placed inside the incubator. Visitors can set and hit their target using the handler. Also, there is a big squid which has a gaming session for kids who could play a four-player race with the squids by each of the levers. Because of robot zoos, children can know more about the ways real-life animals live and move. Also, some marine parks and zoos have started using robots to put less pressure on real life nonhuman animals. Therefore, robot zoo animals may even reduce nonhuman sufferings of the world.

Based on the theme of Kelly et al.'s *The Robot* Zoo, Horniman Museum & Gardens in Southeast London, England exhibit robot zoo animals. Content creators Maddie Moate and her husband Greg share their films of visiting there. One of the sections of the museum is allotted for the robot zoo. First, they attempt to know how a robot grasshopper jumps high. To find their answer, they examine the robot grasshopper, which, like the real-life grasshopper, has half a dozen legs, a couple of wings, and tiny pincers to tear into leaves and grass. Like the real-life grasshopper, Horniman, following John Kelly et al.'s diagram, keeps the bones of the grasshopper outside.

Most importantly, children, young and ageing adults enjoy visiting the robot zoo. With a donation of $50,000 from Highmark and Penn State Health St. Joseph Medical Center, the Reading Public Museum, Pennsylvania exhibited eight animals based on the concept of Kelly et al.'s *The Robot Zoo* in 2023. One of the visitors said, "This was a big hit with our kids there today on a field trip." And another visitor said, "Our granddaughters really enjoyed the Robot Zoo today, as well as the rest of the museum." In 2015, the Boone County Public Library in Burlington, Kentucky ran an exhibition that featured interactive wildlife robots teaching children, young and ageing adults about animals, robotics, and mathematics (Whitehead).

It makes me conclude that the robot zoo exhibitions received high traction if they had regular interactions with visitors. Also, the rhetorical pattern of the digital platforms that I cited here aligns with general people's sense of technooptimism. This paper argues that robot zoo animals serve the same purpose of informing the audience as do scientists and documentary makers of the real-life animals do, but the most crucial thing that is missing from robotic displays is violence, bloodshed, and gory images. It also gives children, young and aging adults the opportunity to learn about animals and robotics with comfort, kindness, and compassion.

CHAPTER 2: VISUAL RHETORIC OF THE ROBOT ZOO

As TRZ's subtitle suggests, it is truly a "mechanical guide to the way Animals work." It has 48 pages, 1.63 lbs.., 0.5x10.7x.13.3 dimensions, and is suitable for students Grade 3 and above (thriftbooks). Although its glossy pictures create interest in preschoolers and primary school students, its linguistic pattern is more suitable for young adults to dig deep into the nuances of the text. For example, my school-going children studying in Grades 1 and 2 love the visuals of the book. When I ask them to read it, they lose their interest because TRZ does not have an accompanying story. Moreover, due to the book's big size, turning over the pages is difficult for children aged eight, seven and five.

Critic George Bodmer argues that the interaction between readers and picture books is "a process that involves us in the text and makes us participants in the story" (79). To see how an illustrated piece becomes an important part of the conversation, some of Bodmer's salient questions could be pertinent for this chapter. He asks, "Does the illustration tell the same story as the words? What is the style of the artwork? How is color used? What do style and color contribute to mood, description, or storytelling? (79)" In the light of TRZ, I will explore Bodmer's questions to analyze the visual components of the text. Moreover, I will allude to the digital platforms to explain and evaluate how the concept of TRZ is being understood and interpreted in digital media.

Even without the words, *TRZ* gives us diverse ways to think and analyze. The book's illustrations of robot animals and living animals evoke curiosity and analytical thoughts in children, young and adult readers. The book is shaped in such a way that it might make someone feel that they are on a tour exhibition watching an eclectic range of robot animals and insects and making comments on them. Apparently, *TRZ* does not have a story; the authors do not create fiction out of those animals; but even without stories *per se, TRZ* enables people to concoct tales and encourage arguments about the visuals. For example, my supervisors look at the images and share one set of analysis, but I may look at them from another perspective, and come with a different pattern of discussion. At times our cultural differences, educational background, age, prestige, status, and experience shape up our thought processes. Even my children who go to the same school have similar and different opinions about the illustrations. Undoubtedly, Kelly et al.'s lack of authorial intervention leaves us with questions to ask and interpretations to share.

TRZ is a book of colorful images. The title of the book on the front cover is written in different shapes and sizes. Each of these letters represents varied materials. For example, "T" looks like a steeled tripod; "h" has pistons, hinges, and joints with a compound eye on top. The letter "e" is shaped like a semicircle spring with some blue cables attached to it. Likewise, the letters "O" on the "Robot" word has springs, circularly shaped, and protected with steely pipes, and attached with black and blue cords and pistons. But one of the "O" s from the "Zoo" word, has hinges, joints and pistons connecting from all sides. The last "O" from the "Zoo" word is oval shaped with steels, pipes, mirrors, one protected gear, and four small cords connecting them both. The letter "T" looks like a modern-day selfie-stick, obviously in metal form. The letters "Z" and "b" have cords, spinal column, fibers, flat joints, nuts, and bolts linked to their regular alphabetical shapes. Moreover, the letter "R" has pipes, nuts and bolts being held up tight with some bends.

*TRZ'*s back cover is in azure color, the same as the front cover. Like the front cover of the book, we see the use of picturized metal objects in graphic details. The headline of the back cover says, "Discover What Makes Animals Tick." Both the front and the back covers look like a building wall blocked in different components. In fact, we find a switchboard and heater switch on the back cover, which carries the head and neck areas of the robot mole, and a smaller version of robot fly. It has some visual receptors, computers for processing messages, sensory receptors for touch, snout, electrical fibers, hinges, joints, shoulder blade, powerful pistons, and pipes. On pages eight and nine, readers can find out more information about the robot mole. Also, on the back cover, a robot fly is depicted with multiple visual receptors, antenna extensions, hinges, suction tube, cords, rubes, strong outer casing, bristles, and cleaning brushes. The full description of the robot fly is available on pages twenty-eight and twenty-nine.

Kelly et al. take inspiration from everyday ordinary items, draw them as similarly as real-life animals, and create different visual effects that look like simulated metal objects. For example, on the first page and the last page, readers should see blue graph papers of statistics. On that graph papers, we see white robot platypuses. It looks as if somebody was watching an ultrasonographic report of a living platypus. *TRZ*'s table of contents has pictures of all the robot animals. Each of them is a smaller version of each section's full-sized robot animal. On the contents page, readers might see a small robot mole looking like a racing car, and platypus being shaped up like a helicopter. Generally, giraffes bend low while eating grass. The robot giraffe on the contents page is vertical. Also, on the right side of the contents page, readers see a robot tortoise, and on the left side of the page, we see a robot platypus. On the bottom right side of the contents page, we see a robot fly, with two other small flies hovering around amidst some distance but in a flying mode.

Then, on the title page, readers see three writers' names: John Kelly, Dr. Philip Whitfield and Obin. Their names are illustrated on a ranch-like shape. All these names are highlighted in black hue. John Kelly's name is used in bigger font than the other two. It is because John Kelly is the first writer. Beneath their names, we see a robot whale mixed with blue, red, and yellow colors. Its tale covers both the pages of the title page. Even the index of pages forty-eight and forty-nine have the images of one robot chameleon and the robot grasshopper, respectively.

The “Introduction” page has a workshop table. Most of the equipment (pistons, hinges, pipes, metal bars, pipes) indicate living animal organs such as muscles, backbones, lungs, horn, ears, brain, jaw, hooves, and intestines are placed on the table. All those robot parts are loosely arranged, but again, they look like a robot rhino. Readers might see a robot rhino white in color placed on a photo frame. At the top of the page, readers see a metal container tied with a rope. It has two connecting pipes and a lid shaped like an eye. Also, on the floor we see a trailer and two-wheeled stairs.

The left-back flap of the front dust cover page is greenish in complexion. We see the frontal portion of the rhino on the back portion of the left dust cover page. Also, the robot giraffe’s external metal body parts are slightly visible. They appear as if the robot giraffe has bent his neck. Its position indicates that the giraffe is on a downward slope. The robot rhino is facing the robot giraffe’s shoulder area. Furthermore, on the same section, Kelly et al. ask some rhetorical questions “How is blood pumped up the six-foot neck of a giraffe? Why does a tortoise have a shell?” They answer immediately, “The Robot Zoo answers these questions and more as it explores the incredible world of animals.” In the same dust cover, Kelly et al. highlight their use of colorful visual images by which they intend to delve further into the mystery of wildlife and nature. From their argument, it could be seen that they use pathogenic elements to rediscover “the magic of nature” through “the genius of engineering” (7). Throughout the book, they carry a positive attitude towards robot animals.

On the right back flap of the dust cover, we find three avatars of the writers. Beside John Kelly’s brief biography, we find a cyborglike head made of pistons, ball and socket, flat joint, brush, audio receptor, glasses, and eyes. His authorial information informs us that he learned art and design by himself. Also, he claims that he is passionate about zoology, too. Therefore, he combines all his interests and passions in designing robot zoo animals. Kelly's colleague Obin is shown with his long blond hair here. He announces himself as an illustrator of T-shirts and logos. For *TRZ*, Obin makes choices of colors and puts them in on the robot animals. The third writer, Dr. Phillip Whitfield's avatar is that of an old man wearing glasses having audio receptors on ears and a diving regulator on his mouth. They use their avatars as authors' profiles. It is all done in a lighthearted manner. Based on Bodmer's questions, and after looking at the colorful images of robot animals, I affirm that the general mood of the book is one of technooptimism. It shows that we can use robot animals to capture images and gather information and data about white life and natural phenomena. For example, the long spring of the robot chameleon has a sticky tongue end. It is attached with a robot fly which captures images and videos when the robot chameleon puts its springing tongue forward (13).

TRZ focuses mostly on robot animals. Yet in most of the pages, we see one male silhouette. It stands straight and has no visible disabilities. The presence of humans highlights that robot zoo animals will have no space without human touch. Moreover, putting human silhouettes besides/beneath pictures of robot animals establishes human ascendency over nonhumans. Also, all the animals have images of their real-life counterparts. In the case of Chameleon, the robot chameleon's eyes, in my opinion, look more fearsome than its living chameleon. Surprisingly, the human silhouette in the blue whale section is extremely tiny. Does it indicate that humans have not yet explored the mystery around many ocean creatures?

One of the ways to popularize the content of robot zoo animals is through the digital media platform. If traditional and independent media outlets promote the need to establish robot zoo animal exhibitions, more people will be interested in visiting robot zoo museums. Their active presence will keep the interest in robot animals alive. As my analysis of the virtual content has shown, the exhibition of the animatronic items with electronic networking creates interest among museum and marine park visitors. They have fun watching and gaining new insights about the animals displayed and they develop a newfound appreciation for real-life animals.

For contemporary scholarly analysis, visual images are crucial because they highlight complex socio-cultural formations with critical insights (Rose 71-2). In comparison, visual rhetoric brings into the conversation multimodal theories and methods for their theoretical framework (Elman 61). Likewise, the visuals of *TRZ* help all stakeholders related with the display of robotic materials to follow the book's model, educate, and entertain readers. From digital platforms, such as YouTube, we see the excitement that robot animals create among children and young adults. To answer Bodmer, I would say, *TRZ* may not convey its meaning clearly without its visuals. It will not be as impactful as it is now without its visuals. Furthermore, the digitization of the book and robot exhibitions bring bigger crowds and inform a diverse range of people about the animal world. Considering this discussion, in Chapter Three, I will discuss how scientists and robot enthusiasts are using robot animals to educate and include conversations about the significance of nonhumans.

CHAPTER 3: ENDANGERED MAMMALS & INNOVATIVE COUNTERPARTS

This chapter focuses on Giraffes, Platypuses and Rhinos, all of whom are endangered animals. I argue that their robotic versions offer a better venue to inform us about their wildlife counterparts. With my analysis, I emphasize that the text and context of The Robot Zoo exhibit characteristics which I associate with positive representation of nature and the environment. The examples that I bring in here give sufficient evidence that the digital representation of robot zoo animals excites children and gives them more concrete details of the animal world. By reading this book and visiting robot zoo animals, children may acquire insightful knowledge of the animal world. True, the establishment of robot zoo industries may not stop gory images from being shown on the digital platform, but to explore the fun side and celebrate the joy of watching nonhumans, I attempt to weigh in the possibilities of analyzing the animal world from a cybernetic world.

Giraffe

John Kelly et al.'s robot giraffe copies the real-life giraffe to describe how they move in the animal world. For example, to describe the giraffe's movements, they use metal objects. The section on the giraffe covers two pages, but one must flip the book to understand its structure. The writers use microphones on the giraffe's hearing, marble balls to analyze their vision, and metal pipes, sharp blades, tubes, brushes, steels, pistons, hinges, bottles, and pressure valves to discuss why a giraffe does not suffer from a stroke despite bending its neck and having the rush of blood running towards the head area. Moreover, the giraffe knows how to stand their ground although they have a larger frontal body but a much heavier back.

Kelly et al. shows that metal objects easily explain that a giraffe has strong shoulders and backbone. Also, the giraffe's first stomach has a bacterial component that helps the animal to separate the hard “vegetable fibers, cellulose” (19 & 20) from the leaves. The giraffe’s second stomach blends the rough fibers in a liquid-like state. And the process goes on four times in total. Scientists model their invention of robot giraffes upon Kelly et al.’s mechanized giraffe. Using their blueprint, scientists have been trying to develop animatronic giraffe’s software for domestic chores and responses to natural disasters. For example, the Robot Engineering Lab of the University Aizu (REL) invented a robot based on the giraffe’s neck to respond to natural disasters (Manawadu et al. 1).

At present, giraffes, like many other nonhuman animals, are facing extinction in the wild (Burton 540). According to Adrian Burton, the number of giraffes has declined by 40% since 1985, and a little less than 100000 are surviving in Africa (540). That is why the International Fund for Animal Welfare (IFAW) has been petitioning the U.S. government to include giraffes as “Endangered” on the U.S. Endangered Species Act (ESA).” If it is termed endangered, the U.S. will not be able to import giraffes for using their internal and external body parts as animal leather products. According to Endangered Species Act,

> The term “endangered species” means any species which is in danger of extinction throughout all or a significant portion of its range other than a species of the Class Insect determined by the Secretary to constitute a pest whose protection under the provisions of this Act would present an overwhelming and overriding risk to man (Section 3.6, NOAA Fisheries).

Although the U.S. government’s decision on whether to include giraffes as endangered species or not is under review and the final decision will come out in 2024, animal rights activists have been hoping for the inclusion of giraffes as endangered species would roll back the years when the number of giraffes was much bigger (Sanerib). According to the Animal Wildlife Foundation, the late nineteenth and twentieth centuries saw twenty to thirty giraffes in each herd, but the number contains “fewer than six individuals” in one herd now.

It is expected that giraffes would live safely in captivity. However, the Copenhagen Zoo's decision of killing Marius, a healthy two-year-old giraffe, for feeding his flesh to the lions from the same zoo brought up international condemnation, and the zoo authorities did not respond to the offers by other zoos including Yorkshire Wildlife Park, Doncaster, England to adopt this animal (Eriksen & Kennedy; Levin 22). The zoo authority went on with their initial plan of killing Marius in front of children and giving them a "three-hour-long demonstration of how to butcher a giraffe" (Smith) because "people are fascinated by it, both adults and children, and they would like to hear stories they normally don't have access to" (Eriksen and Kennedy). Bengt Holst, the zoo's scientific director, later said in a press release, "When breeding success increases it is sometimes necessary to euthanize" (Smith). Since the death of Marius, the Copenhagen Zoo is under public scrutiny. Almost twenty-seven thousand signatories called for the closure of the zoo. Despite repeated complaints, the zoo is still actively running. And the controversy has not left the zoo. In October 2016, a fox from the same zoo entered an antelope closure and killed the prey. On 7 March 2023, a polar bear cub pried open an electrical cable box before dying through electrocution (Freedom for Animals).

History suggests that the sight of giraffes always captivated interest among the public. In 1826/7, Mehmet-Ali, the Pasha of Egypt, as a part of diplomatic ties with France, gave the French King Charles X a gift of a Sudanese giraffe who was a relatively unknown quantity in nineteenth-century France (Lagueux 226). That giraffe died from lung infection on 12 January 1845 (Sharkey 53) when she was 21 years old. Shortly after the giraffe's death, the enthusiastic French cut through their flesh, and displayed the mortal remains or the disemboweled figure of the giraffe to the public all over the country (Lagueux 226). A few days later, French researchers "peeled off and stuffed" their skin (Sharkey 53).

Even in the Renaissance age, giraffes were used to improving diplomatic ties between Muslim Africans and European Christians. For example, in 1486 Lorenzo il Magnifico of Florence was presented with a giraffe by Al Ashraf Kait-Bey, the sultan of Egypt in 1486 (Ringmar 382). When the Florentines saw a giraffe for the first time, they were in utter shock and disbelief at the gigantic neck of the giraffe (382). Even now, millions of viewers coming to the French National Museum of Natural History will be able to see four large stuffed giraffes who are the most popular ones because of their iconic neck, height, and history (Milo 28-9).

Scientists have been innovating robot giraffes for use in different activities. For instance, Boston Dynamics, owned by Google, unleashed a fifty-five-pound robot giraffe, which can use their long neck to "dispose of trash and reach household items like dishes in a dishwater," can work constantly on one charge for one hour and thirty minutes (Eadicicco). Observing that some robots do not have flexible movements while doing their task, Atsuhiko Nikura et al. developed "powerful and flexible long musculoskeletal robot based on the anatomy of a giraffe neck" to establish their point that the robot giraffes are flexible. They slip during their work, but they succeed in lifting themselves up even after falling (Eadicicco). In 2006, a part-time laser-light-show designer, Lindsay Lawlor invented a seventeen-hundred-pound robotic giraffe consisting of "40 strobes, 400 LEDs and loudspeakers, computer-controlled flashing giraffe spots" and "an electroluminescent circulatory system and a gas grill" (Haney 71).

Lowlor's innovation got so famous that he got invited by former U.S. President Barack Obama to show his 17tt-tall robotic giraffe (Wrath). To encourage innovations in businesses, education, science & technology, the Obama administration inaugurated the "White House Maker Faire" and Lawlor's giraffe was part of the show. Seeing Lawlor's giraffe named Russel, Obama says, "Look at this! I like those ears" (Campbell). In a video shared as part of an audiovisual report on Lowlor's innovative giraffe named Russel, people are shown petting Russel, who responds to their touch by saying, "He. He. He. That tickles. That feels nice" (Modrigal).

Since the number of giraffes is on the decline, boundary objects have been trying to popularize the user and usability of robot giraffes to enable children to learn more about real-life giraffes the fun way through constant interaction. Also, robot giraffes, as my analysis has shown, are used in different capacities to ward off natural disasters and run household errands. Moreover, all the contextual analysis establishes my claim that people have fun and receive vital information about real-life animals in robot zoos. To teach human children about anatomy, living giraffes need not be killed. Instead, the visual and digital representation of robot giraffes should be a better substitute to killing giraffes indiscriminately.

Platypus

In the entry on the Platypus in *TRZ*, we learn that Australia is the origin of the Platypus, the species later brought to England in the eighteenth century. The entry on the platypus covers almost two pages and includes two images: one containing the robot platypus and the other a real-life one (Kelly et al. 15-16). With the making of the mechanized animals, Kelly et al. illustrates how the living platypus moves, swims, burrows, and lays eggs on the riverbank. They use electrical sensors, electrical cords, steely snouts, sensor pads, pressure sensors, computers, big pistons, pipes, and flippers to depict the activity of a living platypus.

At the bottom of the first page, the authors provide a small "Platypus Facts" (15) box which contains, in bullet points, the country of origin, habitat and length and weight of the real-life platypus. They live in lakes and rivers in Tasmania and Papua New Guinea, an independent country near Australia. Approximately, they are eighteen inches in length and one point eighth to two point three kilograms in weight. The authors also mention at the bottom of page fifteen that the platypus has two big front feet which are webbed. When they extend their flaps, the paddles become strong for swimming. When the flaps turned their back, the claws come out to dig a burrow in a riverbank (Kelly et al. 15).

Killing of the Platypus for scientific explorations was a practice quite common among scientists in the nineteenth and twentieth centuries in western countries. One such example of Platypus killing is found in Scottish Zoologist William Hay Caldwell's diary dated 25 August 1884 (qtd. in Hall 216). Moreover, platypus and humans encounter direct competition against each other to use "the fresh waterways on the eastern side of the arid Australian continent" (Pettigrew et al. 1199). In June of 1958, two female platypuses and one male platypus were brought to the New York Zoological Society for $7,000, but none of them, despite the best care, survived for more than a couple of years (Tall 218-9). One of the factors that led to the early demise of living platypuses is due to scientists' "lack of quantitative information" and uncritical assessment (Grant and Smith 1989).

Due to drought, pollution, bushfires, deforestation, and predators (crocodiles, dogs, eagles, foxes, goannas, snakes water rats and humans), the platypus populations in Australia have been on the decline for one hundred to two hundred years (WWF Australia). To regenerate the growth of platypuses in the Royal National Park in Sydney, WWF-Australia in 2021 embarked on a three-year project with a team of collaborators, such as researchers, scientists, rangers, and ecologists from different disciplines. For doing their work, they planned to journey through places to a) confirm the exact number of living platypuses, b) locate favorable places for reproduction, c) identify "potential source populations" and d) develop "ecosystem health" and e) rewild the animal in opportune places ("Rewilding the Platypus") Throughout the process, they use science and local environmental knowledge to "restore Australia's ecosystems ("Rewilding the Platypus").

Although the future of the living platypus is in doubt, the robot platypus is gathering more traction, followers, subscribers, and followers due to the growth of robotics engineering. In 1989, American artists named Eduardo Kac and Ed Bennett displayed an artwork called "Ornittorinco" which is translated as "Platypus" in English (Robbins & Smith 44). The duo shared their-video live on screen, using a "telephone keypad-like controller" (44) to engage with the audience while preparing the robot platypus as an artwork (45). Kac and Bennet used telematic materials to get wired with participants from different parts of the world to emphasize "the possibilities of real-time dialogic exchange" to exhibit how an electronic platypus worked after their experimentation (Drucker 18).

In robot zoos, children enjoy the fact that they can interact with nonhuman animals in an interactive way. One of the YouTube channels, Marky's Adventure Life, shows a young boy watching a robot platypus moving inside the incubator. The boy's name is Mark. His mother is asking, "Can you show me how it works, Mark?" Outside the incubator, there are a couple of buttons for interacting with the robot platypus. Then, Mark and his mother press the two buttons, one of which is used to flip the head of the robot platypus, and the other one is used to move the flippers. In appearance, it looks like the platypus of *TRZ*. However, the platypus of the exhibition moves and interacts with its audience. Therefore, robot zoo exhibition owners and technicians modify the mechanized objects to create engagement with the viewers. Also, outside the incubator of the robot platypus, viewers see a digital plaque where the exact information of page number fifteen of *The Robot Zoo* is placed. By interacting with the robot platypus, children like the Markys can watch how robot animals work and move. With regular interaction, they become more knowledgeable about living animals, too.

Rhinoceros

In *TRZ*, the robot rhino is as big as the real-life nonhuman animal (Kelly et al. 25). The authors depict their animatronic rhino as having strong external armor and a steely horn. Like other robots, this animatronic version of rhino has audiovisual receptors, pistons, solid cases, and a metallic oxpecker replicating and representing the birds who clean mites and ticks from the skin of a rhino in the real world (Kelly et al. 24). The book uses a fact box to inform readers that Black rhinoceroses originate from Africa, and live in the rainforest and dry lands, growing as tall as four and a half to five and a half feet and weighing around nine fifty to one thousand and three hundred kilograms (24). My discussion shows that the digital media outlets become excited when scientists declare the news of an invention of a new robot animal. Therefore, robot zoos use their platforms to disseminate more information about the loss of rhino habitats and create awareness about the need to protect nonhumans for raising conscience among children and young adults about protecting the environment.

In the wild South African and Zimbabwean poachers illegally kill rhinoceros to collect their horns and trade them to other countries for larger profit (Donovan 53). In Kruger National Park, South Africa, the rhino's declining population causes disruption in the cycle of nature (Everatt 65). Although conservationist efforts have stopped extinction of nonhuman rhinoceros to some extent, the global demand for their horns has never subsided among capitalist companies in Japan, Yemen, South Korea, and Taiwan (65). According to WorldWide Life, half a million rhinos lived in Africa and Asia in the 20th-century, but now the number is hovering around 27,000; most of them are living in protected sanctuaries. Protecting rhinos from mass extinction has become many conservationist agencies' main objective. Some of them translocate rhinos from one place to another place for conservation. However, these initiatives bring their own causes. Translocations of rhinoceros also cause their untimely demise. For example, four rhinoceroses in South Africa survived without trouble for five-and-a-half years, but they died, because of lack of nutritious foods when they were relocated to Chad's Zakouma National Park in 2018 (Green).

Fearing the worst that the number of northern white rhinos would be wiped off from Kenya, Dr. Natalie Cooper and her team collected semen and eggs from the northern rhino living species before preserving the substances at a lab in Berlin (Busby). They plan to use the stored semen and egg on living rhinoceroses to keep a healthy number of them alive (Green). Since the declining Northern rhino number is in a single digit, scientists, understanding the gravity of the situation, created a snakelike robot catheter to create an embryo "repopulate critically endangered species and counter some of the unfortunate poaching that has been going on around the world" (Labios). In Malaysia, a Sumatran rhino named Iman was the last one to die in 2019. To avoid such dreadful consequences, researchers at the International Islamic University Malaysia (IIUM) used living rhino cells and issues to a) surrogate them among rhino relatives; or b) borrow the egg of a surrogate rhino, move aside the nucleus, and mix it with a Sumatran bodily cell (Yeung).

If the practice of poaching continues, nonhuman Rhinos will continue to disappear (Yeung). Scientists like Pierre Comizzoli think that regrowing rhinoceros' species through lab work does more good than harm (Yeung). Using "assisted reproduction, stem cell biology and gene editing", rhinoceros could be saved from being extinct (Pilcher). Realizing the importance of lab work to protect animal species, Scientist Comizzoly says,

> This is the only way to go, right now. This is a really ambitious project. But if we really want to regenerate and resurrect that species, this is the kind of approach that has to be taken (Yeung).

Raising awareness about the loss of rhino habitats is an important first step toward saving them (Platt). Because of the growing awareness of the dangers encountering rhinos, in the last decades more attempts have been made to protect rhinos through animal sanctuaries, but those works have not increased the survival rate of rhinos outside national parks and game reserves (Baisas). Clearly, the future of the rhinoceros' species is threatened because real-life rhinos are brutally killed and commodified. The shrinking number of rhinoceros population is a cause for alarm. They have fallen prey to capitalist greed and poachers' mercenary tendencies. Kelly et al.'s portrayal of the robot rhino and my earlier rhetorical position around robot animals establish the point that electronic zoos bring excitement and disseminate information about extinct animals among children, and its display does not threaten anyone's life.

Scientists have been inventing innovative ways to encourage people to interact with robot rhinos. Instead of bothering real-life rhinos, researchers and big companies have begun to realize the significance of using robot animals for interactions. For instance, a Japanese company named Sansei Technologies designed a 11-feet long and five-feet wide robot rhinoceros to help Amusement Park visitors take a ride on it (Neece). Looking like a minivan, the robot rhinoceros with usual four legs can hold on to four passengers and give numerous visitors a "totally new experience of the dynamic motion" which "riders can feel with their whole body" (Sensei quoted in Tangermann). Through this paper, I keep on urging relevant stakeholders to have robot zoo exhibitions to educate folks about real-life animals with delightful activities.

CHAPTER 4: ROBOTS FOR INSTRUMENTAL KNOWLEDGE

In real-life, who does have empathy for flies? Mostly, they are treated as pests. Manufacturers produce insect repellants to destroy the larva of flies and mosquitoes. When a giraffe dies, people have more sympathy for the animal. However, people do not have any concern when a fly dies. People treat flies as dangerous insects. If they latch onto a food, it becomes contaminated. Therefore, people kill them. But Kelly et al. do not see houseflies negatively. They dub the house fly as "an amazingly complicated animal" (29). Likewise, chameleon is not extinct. They capture people's fascination because of their capacity to change colors. The rhetorical concern of this chapter does not position house flies, chameleons, bats, and grasshoppers as endangered species. Kelly et al. create robot counterparts of grasshoppers, bats, house flies and chameleons to show that humans can use them for instrumental knowledge or solving practical problems. Thus, reading the rest of this chapter will give readers an idea about how scientists and researchers use robotic forms of house flies, chameleons, bats, and grasshoppers for innovation in mechanical and construction engineering.

House Fly

The authors draw the picture of a robot fly copying the real-life insect. The robot fly that Kelly et al. draw has visual receptors on all parts of the insect's head. As a result, the robot can fly from a 360-degree angle. They do not have to check their blind spots to see something. With their microchip system located near the eyes, the robot fly keeps other sections of their body active (Kelly et al. 28). From the body of the book's house fly, I find a) head: containing eyes and mouth, b) mid-section: comprising 6 legs and 2 wings and c) the hind section which holds the rest of their body organs (Kelly et al. 29). Also, the house fly does not have a skeleton inside; instead, their skin outside is as hard as a shell (Kelly et al. 29).

The experiment on robot house flies began even before *The Robot Zoo* was published. For example, in 1991, Nicolas Franceschini et al. produced a 50-cm robot fly, which could reach their target at a fast pace and greater adaptability (934). Also, in the early 2000s, Scientist Sweta Agarwal's dissertation "Fly, Robot: The use of a controllable fly robot to explore object recognition and visual tracking during courtship in Drosophila" from University of Washington uses the robot fly to investigate how fruit flies use their vision and senses to find their sexual companion (55). In 2013, for the first time in the U.S Researchers developed a robot fly that could copy the full range of insect flight and flap their wings as many as 120 seconds per second; almost close to a housefly's flapping rate which stands at "200 cycles per second" (Cowen; *Wired)*. Although the robot fly requires a tiny battery which is harder to make, and its tiny shape might create an obstacle to gather the speed to fly, the invention would be used in pollinating crops amid "dwindling bee populations."

Robot flies are tiny but vulnerable in controlling flights (Wood). Robert Wood argues that in disaster-prone areas a lot of robot flies can do rescue work and sniff survivors' body warmth and breadth to determine how much life each living person has. He posits that the type of robot flies they have created at Harvard University can fly amidst rabbles, send radio signals to the rescuers, and study behaviors of insects (25-9). About the utility of a robot fly, Wood informs that studying biology of animals is easier with robot flies because they have "much broader applications" (qtd. in Skirble*)*. Similarly, Rafal Zbikowski and his cohort built a Micro Air Vehicle (MAV) that flaps its wings like a house fly (10). Their invention is supposed to help military personnel to glean information about rival territories. Also, the researchers put small cameras on real flies to record their flights. They housed the real flies in a cage and showed them the visuals of their movements that were recorded before (10), to observe "how the flies' neuron light up in response to these pictures" (10).

Researchers from University of Washington have been trying to create a robot-insect which would not depend on a wire which was "attached to an external power force" (qtd. in Booth). Earlier robot flies ran out of battery within 30 minutes of its start. To mitigate the problem, some scientists have created equipment that would save battery life and would be as cheap as $20 (Booth). One of the researchers Chukewad told *TechExplore* in 2020 that building robofly is difficult because its chip is so small that losing one of them would end up ruining the whole project of creating a small drone (Fadelli). He claims that their robofly is flexible because of its small size and wireless movements, which could help "human users to detect gas leaks" and "search for pollutants or leaks of potentially hazardous fluids" (Fadelli). With the advent of science and technology, there is a growing tendency among scientists and researchers to upgrade the quality of flying machines. Also, in architecture, flying robots are concurrently used for building design and construction (Mirjan et al. 270).

Seeing the ruination of honeybee hives because of natural disasters, in 2009 Robert Wood, Radhika Nagpal and Gu-Yeon Wei created the blueprint for developing robotic beehives to find alternative options for commercial pollination in the U.S (65). Although Nagpal, Wood and Wei succeeded in their plan to create a robofly, they admitted in 2013 that robotic fly, named as RoboBees might require a lot of upgrading in the future to make it more sustainable and consumer friendly. One of the ways of becoming successful in robot fly creation is to be patient with the work and accept the fact that there would be mistakes happening along the way (Wood et al. 65).

Chameleon

Kelly et al.'s robot chameleon is perching on a branch. It has green, ash, red, yellow, orange, red, blue, and white complexions. It has a sticky tongue end where we see a small robot insect attached, showing that the latter is being caught and soon will be swallowed. Inside the robot chameleon, we see a tube containing red liquid and red cords. It has protective spikes, flat video screens to show camouflage patterns, hip joints, electrical fibers protected by flexible framework, coiled tubes, food processor, waste disposal unit, food and air intake pipes, visual receptors, air and scent inlets and spikes. Kelly et al. attach a "forward-pointing spike" with the spring coiling around it; the front end of the spring is connected to flypaper to catch robot fly (13).

Kelly et al. describe the living chameleon on the top right corner side of page thirteen. Also, they use a box on the lower portion of the same page. Inside the box, we find a real chameleon with a light greenish color on it. Furthermore, the anatomical diagram of the real chameleon indicates where rib, skin scales, stomach, eyes, nostril, tongue, windpipe, intestine, skin cells and strong tail are located. Kelly et al scruff off the skin behind the chameleon's head to show their rib and vertebra. Readers may know that chameleon is famous for changing colors to adjust. They locate their prey with revolving eyes and use their sticky-tipped tongue to catch their prey. Kelly et al. dub chameleons as "talented lizards" (13) because of their ability to change complexion. The real chameleon is pictured to be smaller than the real chameleon. The authors describe how chameleons use their tongue, bone pressure and muscle power to catch their prey (13).

Chameleons are some of the few nonhuman animals capable of changing their color. They change their color on various occasions and for disparate reasons. Female chameleons from the Mediterranean region show more yellow spots when they become interested in attracting male chameleons for courtship (Cuadrado 395). In the last two decades, researchers have been trying to discover how the chameleon effect works on visual rhetoric. In 2004/5, Researchers Jeremy N. Bailenson and Nick Yee made an experiment on two groups of participants. One group's prerecorded video did not use any filter, but the other group's recording had visual effects of appropriate color changes. They conducted the experiment using "computer algorithms" (814). Their results demonstrated that the unfiltered visuals received less positive feedback than the ones with visual effects.

Chameleon's color-changing process encourages researchers across various fields to apply. Inspired by nonhuman animals' diversity of colors, researchers have created sensors with infrared lights, which help robots to use in navigating "dangerous fire zones" (4). Therefore, it shows the continual significance of observing eclectic digital organisms in the context of robotic exploration (4). Color-changing nonhuman animals such as chameleons inspire the design of new software machines to investigate deeply how animals' behavior changes when the mutation process takes place (Morin 832). Likewise, Kim Hyeonseok et al. developed a superficial camouflage that shapes its color instantaneously and systematically to "match the background colors the robot crawls over" (1, and Kim). using the chameleon model of color-changing patterns in 2021.

According to Shi En Kim, Hyeonseok et al.'s creation might propel interested parties to design a novel catalog of "active camouflage wear for military applications" or help fashion designers splash disparate hues based on closest backgrounds. Moreover, their creation, just like real-life chameleons, matches the color of the nearest environment, and it can ambush itself inside plant species. Regarding its adaptability, the University of Nebraska-Lincoln chemist

Steven Morin suspects that the robot chameleon might struggle to work properly if the weather is extremely cold or hot (Shi Kim). Many researchers have moved towards creating soft robots based on the biology of real-life nonhuman animals. Following the activity of chameleon's tongue-strike, Ramses V. Martinez et al. improved a new range of robots that are soft and capable of reproducing high power, energy, and speed because of its "stored elastic energy." Their reason for choosing robot chameleons is to develop robots that would have the capacity to perform big tasks of high stakes with accuracy and velocity which big traditional robots may fail to do because of their "heavy motions that slow down their motion due to inertia" (Martinez quoted in "Chameleon's Tongue Strike Inspires Fast-acting Robots That Catch Live Insects in the Blink of an Eye").

University of California, Riverside researchers also worked on Chameleon's biological color-changing patterns to create their own version of robotics. In 2020, they introduced a machine of different clusters of colors which painters would benefit from using. For example, painters could have wanted to use that machine to create a variety of colors from different angles. That robot machine might have propelled painters to experiment with their work of art and allow connoisseurs of art to watch those contents in distinct colors from multifaceted angles. According to Zhiwei Li, one of the researchers of that experiment, said, "It would be wonderful to see how the science in our work could be combined with the beauty of art (quoted in Bernstein)."

Grasshopper

John Kelly et al.'s robot grasshopper presents similarities with the real-life grasshopper. They have audio-visual receptors, steely frames, pistons, minicomputers, large springs which help the multi-jointed jumping kegs to release the winged robot grasshopper into the air (27).

The authors show the mechanized grasshopper textually and visually to give researchers creative ways of using the robot. It is not clear whether researchers follow the book's manual for making their robots. At least, there is no evidence of acknowledgment. However, most of the recent-past creations of robot grasshoppers are modified versions of Kelly et al.'s textual-visual creation.

Inspired by real-life grasshoppers, the robotic counterparts created by the Swiss Federal Institutes of Technology in Lausanne, also have two small legs that require springs to jump higher; for example, the one that was created in 2008 could leap 27 times and would be used in covering long distances and gathering analytics in disaster-prone areas (Kleiner). With every invention, scientists are trying to update mechanical tools to update robot grasshoppers' flexibility, because it is not easy to cope with living grasshoppers (Paul). Carnegie Mellon's College of Engineering in 2023 upskilled robot grasshopper's jumping movement; hence, unlike the previous equipment, these devices could independently and automatically preserve energy through their surroundings for gathering some momentum before the higher boost. At present, scientists are improving unorthodox technologies that would allow robots of the future to exceed the limits of nonhuman biology (Brahmbhatt). With that being in sight, the University of Colorado Boulder researchers improved a material that would elevate the jumping height of grasshoppers, almost 10 times higher than living grasshoppers (Brahmbhatt). Of the utility of their newly invented robot grasshopper, one of the researchers, working on the grasshopper project, said,

> Jumping can also be utilized for the locomotion of small robots on uneven terrains, either directly, either directly or as a mechanism auxiliary to other locomotion mechanisms such as walking, crawling, inching, etc (Brahmbhatt).

Also, with the creation of new technological tools, scientists have been able to record information about nonhuman animals' jumping abilities. For instance, researchers have now begun to discover that grasshoppers preserve the energy of their hind legs in springs that are attached to the joints. Because of using those springs, grasshoppers can jump as high as humans although the former is much lower in body length. Therefore, it establishes the belief that AI has been helping animal researchers to discover new meanings of nonhuman animal movements and activities in robotics and digital platforms. Moreover, AI contributes to human understanding of biodiversity and species (Green).

Bat

Kelly et al. describe the features of a bat. They posit that bats are more active at night but roost upside-down with their clawed hind feet before the sunset (16). Using echolocation, bats drink animal blood, eat fruits and vegetables, and swim on the lakeshores (16). On the other hand, robot bats they envision have not-too-heavy tubes, pistons, software programs, ultrasonic sounds, wing flaps and struts. Also, in another box of the page, readers find information. Kelly et al. inform bats cannot live in harsh climates. They can go from six-sixty inches, weighing between seven and one point four kilograms.

Soon-Jo Chung of Caltech designed a robot bat which they named Bat Bot which does not have the usual forty active passive and active joints that usual real-life joints have; instead, their creation has nine joints, sensors, receptors (Herkewitz**).** Although robot bats may not fly as high and wide as other flying robots, Chung's team argues that the soft layer of Bat Bot makes it safe around humans; it could go around building and construction sights, capture photos and find glaring errors. Regarding their creation, Caltech published an article, which unlike William Hetwewitz's piece has more eyewitness accounts from the researchers themselves. In Caltech's newsletter, Chung is quoted as saying, "This robot design will help us build safer and more efficient flying robots, and also give us more insight into the way bats fly" (Saunders). When the bat moves up, its membranes conserve air and deform; while it goes down, the membranes go back to their original pattern and take out the air, resulting in a swift turbocharge for the flap.

Bats inspire researchers to create animatronics to mimic their gestures and posture. For example, Tel Aviv University researchers invented a mechanical robot named Robat, which, like a bat, produces sounds and detects echoes coming through to identify and navigate barriers outside. To create this artificial robot, the researchers invented ultrasonic receptors and speakers to examine how bats move in a new direction and map the location based on echoes (Solomon). One of the aims of this robot bat is to copy animals to get a clear picture of the barrier rear-lifeboats encounter in the real world. Like all scientists of a new model of robots, the Tel Aviv scientists also claim that their creation is advanced in comparison to other previous and contemporary robots. One of the reasons for that claim is that their robot is independent and can generate "a map of open routes where it can move" and know how to identify new particles based on echo information. In the future, they are aiming their robots to be faster.

Bats suffer the effects of climate change (Popa-Lisseanu et al. 1286). Moreover, the growth of white fungus on bats' wing membranes, muzzles, and skin led to the deaths of thousands of bats in 2007 in America. One of the reasons suspected of the development of white fungus is bats' lack of availability to find food in winter. Angela D. Luis et al. argues that bats spread zoonotic viruses to other mammals that may include humans. However, they agree that "the mechanisms of interspecific transfer of pathogens, particularly to humans, remain poorly understood" (7). Janet Pelley, in her article, "Could the Novel Coronavirus Infect North American Bats" searches for the answer whether humans could infect bats with novel coronavirus in America. She talked to a couple of researchers to find the answer. Among them, Kevin Olivia, an ecologist from EcoHealth Alliance, conducted a study on bats to see whether they had beta coronaviruses or not. After reviewing literature of beta coronaviruses, they found no evidence of bats getting afflicted with SARS-CoV-2 from humans (Pelley 481). Bats endure most of criticism for the spread of coronaviruses. Scientists have not made things easy for them.

Scientists Quentin C.K. Hazard et al. argue that construction of new dams and hydropower development in Malaysia have resulted in loss of forests on which species such as bats rely on (9). Similarly in the Amazon, the hydropower projects contributed to the loss of habitats for many bats and other vertebrates (Teixeira et al. 61). Despite the arid climate for bat conservation in Algeria, Hibat Ellah Loumassine suggests it is possible to conserve bats by exploring their echolocation and habitual quality even within desertification and river damming (180).

Bats are important for the ecosystem. In some other places of the world, bat conservation is going on. In Nepal, to save bats and other nonhuman animals of similar size from extinction, Small Mammals Conservation and Research Foundation (SMCRF) was established in 2008. Despite their financial shortages and lack of modern equipment, Nepalese researchers have been striving hard to repopulate bats and rescue them from human territories to send them to the wide (Joshi). One of the biggest impacts that bats play on ecology is they eat potentially harmful insects; it helps farmers to grow on their lands and generate revenues (Joshi). If robot bats continue to spread information about real-life bats, visitors to animatronic zoos will be able to know about their living habitats and precarious conditions in the face of global climate changes.

Thankfully, House Fly, Grasshopper, Chameleon and Bat do not face extinction. This paper shows how scientists are replicating the heights and zips of these flying beings to create automatons for wildlife conservation, building and construction engineering. Due to the constant advancement of science and technology, the robot House Fly, Grasshopper, Chameleon, and Bat help researchers monitor real-life animal and insects' behavior, record and analyze the data collected from their investigations. The significance of TRZ is that it showed everyone how robots, such as house flies, chameleons, bats, and grasshoppers could be invented, worked on, produced, and manufactured. Through TRZ, they provided a model for scientists to explore and expand. Putting TRZ as a base, every year scientists have been looking to update the working process of house flies, chameleons, bats, and grasshoppers with updated technology to gain new insights about different branches of knowledge to eke out a better world for humans and nonhumans.

CONCLUSION

Throughout my paper, "From Pages to Places: Situating John Kelly et al.'s *The Robot Zoo: A Mechanical Guide to the Way Animals Work,* I argue that robot animals can promote animal conservation. One of the ways I suggest for encouraging animal conservation is to create mechatronic versions of extinct animals for displays and interactions through robot exhibitions in the Fargo-Moorhead area. Following John Kelly et al.'s method of making robot animals, we can bring many extinct animals to life, albeit in a mechatronic form. I understand that people will be able to gain the knowledge of animal disappearances through electronic and social media platforms, but I posit that visiting a robot exhibition enables people to socialize with others, spend good times together, and get educated about the dreadful consequences of environmental ruinations on real-life animals' loss of habitat.

The idea of going to robot animal exhibitions is a new concept which many people may grapple with in Fargo-Moorhead. A lot of critics may disagree with my proposal to establish robot zoo exhibitions here. I would appreciate their thoughts. Still, I would request the Board of Education of the City of Fargo to welcome my ideas and allocate some budget to establish the first robot zoo exhibition in Fargo. If needed, I am willing to speak with the leadership groups of the Fargo-Moorhead area to state my position about using the concept of John Kelly et al.'s book but with more updated software to display robot animals in museums and exhibitions. Therefore, I affirm my positive belief in the rhetoric of science and technology to posit that electronic animatrons give robot museum/exhibition/zoo visitors chances to interact with robots and learn in-depth textually, visually, and digitally about real-life animals. As stated earlier, some states, based on Kelly et al.'s *The Robot* Zoo, exhibit robot zoo animals in the U.S. Hopefully, the Fargo-Moorhead community will follow others' suit soon.

At the beginning of this paper, I discussed the earliest phase of the internet to emphasize people's curiosity about the latest invention of technology in 1994. I take note of people's skepticism and celebratory attitude towards the rise of the internet. Out of curiosity, I investigate Kelly et al.'s TRZ to interpret what the book is all about. The book has not received any attention from critics. That piqued my interest to dig deep into the text, to interpret how people are translating the concept of its robot animals into exhibitions, public displays, and scientific discoveries. Taking a leaf out of Donna Haraway's embracing of technology, I state that the robot zoo animals are a welcome addition to the rhetoric of science and technology. My discoveries prove that children and young adults love watching robot zoo animals in exhibitions and public displays. Moreover, scientists have been using robot zoo animals for instrumental knowledge. The kind of curiosity the internet created in 1994, children, young and aging adults have the same level of fascination about robot zoo animals.

In Chapter 1, I wrote about the existence of robot zoos in Massachusetts, Pennsylvania, and Kentucky. All these robot animals are modeled on Kelly et al.'s TRZ. In fact, Chicago debuted the first robot zoo exhibition in 1998, four years after the publication of TRZ. In the following years, all other exhibitions glean information from TRZ to arrange their robot zoo exhibitions which attract children, young and ageing adults. For example, the Reading Public Musuem, Pennsylvania exhibitions display robot zoo animals which bring grandparents, parents, and grandchildren together. And all of them love the concept of TRZ.

Based on George Bodmer's questions "Does the illustration tell the same story as the words? What is the style of the artwork? How is color used? What do style and color contribute to mood, description, or storytelling?" in Chapter Two, I analyze seven of the eight animals from the book. For Chapter Two, I analyze the visual images of the book to interpret the authors' rhetorical appeals. Chapter III focuses on the endangered animals such as Giraffes, Platypuses, and Rhinos. I argue that robot zoo animals can give children and young children concrete ideas about how climate change and illegal poachers' encroachment on real-life animal territories is putting animals' lives in danger. With interaction with robot zoo animals, children and young learners should be able to have fun and educate themselves about the need to protect wildlife, and the environment. However, in Chapter IV, I do not identify houseflies, chameleons, grasshoppers, and bats as endangered species. Instead, I analyze that chapter to inform my readers about scientists' exploration of these animals and insects to generate data for gathering information about real life animals, and their habitat.

I reiterate my earlier point that The Robot Zoo will not end animal cruelty and suffering. Still, I advocate for more establishment of robot zoos in the U.S. because they create a platform for children and young adults to initiate discussions about animal behavior, climate change, and animal plights. Additionally, the concept of Kelly et al.'s *TRZ,* as my earlier discussion of Chapter 1 shows, should continue to attract people with interactive digital media contents (be it sound, music, AI tools, video editing, etc) and visual images. After analyzing *TRZ* and seeing the reconstruction of the book's manuals, I contend that the future of robot zoo animals is healthy. As the advancement in science & technology shows, we have more modern equipment and tools to manufacture robot zoo animals. With every set of innovations, entrepreneurs have been thinking of ways to update robot animals' software. Hence, more people in the U.S. will be finding mechanized animals that are more modern than what *TRZ* suggested in 1994. Likewise, I strongly recommend new robot zoo establishments not only in the Fargo-Moorhead area, but all around the world.

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