1995

Collaborative Multimedia

Judy Diamond

University of Nebraska–Lincoln, jdiamond1@unl.edu

Alan B. Bond

University of Nebraska–Lincoln, abond1@unl.edu

Beth Schenker

University of Nebraska–Lincoln

Debra Meier

University of Nebraska–Lincoln, dmeier1@unl.edu

Dana Twersky

University of Nebraska State Museum

Follow this and additional works at: <http://digitalcommons.unl.edu/bioscibond>

Part of the [Animal Sciences Commons](#), [Biodiversity Commons](#), [Ecology and Evolutionary Biology Commons](#), [Environmental Studies Commons](#), [Museum Studies Commons](#), and the [Science and Technology Studies Commons](#)

Diamond, Judy; Bond, Alan B.; Schenker, Beth; Meier, Debra; and Twersky, Dana, "Collaborative Multimedia" (1995). *Alan Bond Publications*. 12.

<http://digitalcommons.unl.edu/bioscibond/12>

This Article is brought to you for free and open access by the Papers in the Biological Sciences at DigitalCommons@University of Nebraska - Lincoln. It has been accepted for inclusion in Alan Bond Publications by an authorized administrator of DigitalCommons@University of Nebraska - Lincoln.

Collaborative Multimedia

Judy Diamond, Alan Bond, Beth Schenker, Debra Meier, Dana Twersky

ABSTRACT Six natural history institutions contributed video and other images to produce a single multimedia exhibit about famous paleontology sites throughout the United States. In *Mesozoic Monsters, Mammals and Magnolias*, users can view videos of the original excavation of each of the sites and also play computer games relating to each location. This project provides a model for how collaboration among museums can reduce the cost of multimedia exhibits while improving quality and making them available to wider audiences.

MULTIMEDIA PARTNERSHIP

The small girl examines the bones of a mosasaur, a giant fossil reptile 20 times her size. Then she turns to the nearby multimedia exhibit, makes a selection from a map of North America, and watches paleontologists excavate that skeleton from the ground.

Multimedia in natural history museums is changing how people think about natural history specimens such as fossils. Through video and animation, static animals in dioramas can now come to life, displaying characteristic and intriguing behaviors. Fossils can take visitors on time travel, showing strange ancient environments, with plants and animals that no longer exist. Organisms that look like nothing known today seek mates, care for their young, and fight for survival.

Multimedia makes this all possible. Technologies that are interactive, durable, and flexible enough to be used in informal education are now widely available. These make multimedia one of the fastest-growing areas of museum exhibit development (Keizer, 1994). Multimedia is well recognized by museums today as a powerful educational medium. Multimedia exhibits are, however, relatively expensive to produce, particularly if they depend on high-quality video or still images. The cost of purchasing rights to images can be one of the most expensive elements of developing multimedia.

The University of Nebraska State Museum invited five other natural history institutions to become members of a multimedia consortium. The result of that collaborative effort is *Mesozoic Monsters, Mammals and Magnolias*. The Nebraska team was the primary developer, and the other consortium members contributed in significant ways. Most importantly, the consortium enabled us to obtain high-quality images and keep overall costs reasonable.

Each of the participating institutions owns original video of significant Mesozoic excavations in the United States, video that was contributed in exchange for rights to use the completed exhibit. In addition to contributing images and video, each institution reviewed and commented on the parts of the program that related to its work. The consortium members include the University of Nebraska State Museum, The Carnegie Museum of Natural History, the Denver Museum of Natural History, the Museum of the Rockies, the Royal Tyrrell Museum of Paleontology, and Meteor Crater Enterprises, Inc.

Judy Diamond is associate professor and assistant director for public programs; Beth Schenker, video coordinator; Debra Meier, supervisor of exhibits; and Dana Twersky, evaluator at the University of Nebraska State Museum, Morrill Hall, Lincoln, Nebraska 68588-0332. Alan Bond is research professor in the Department of Biological Sciences at the University of Nebraska.

INTERACTIVE PALEONTOLOGY

Although the public is fascinated with paleontologists' discoveries, museum visitors do not always understand how they come about. This exhibition introduces the work of paleontologists at eight different sites that have yielded fossils from the Mesozoic Era (250 million to 65 million years ago). The Mesozoic is known primarily for the dominance of reptiles, particularly the dinosaurs, but many other important evolutionary events occurred during this period. Flowering plants first appeared and then diversified, and the modern groups of mammals also had their origins in the Mesozoic.

This five-year-old compares her foot to the tracks of the horned dinosaur, Chasmosaurus. The floor of one-half of the entire gallery is a walkable trackway of an adult and baby of this species.

Sites from around North America that had contributed important discoveries in the past and present history of paleontology were chosen. Some, such as the dinosaur trackway in Glen Rose, Texas, and the bone bed in Dinosaur National Monument, had originally been excavated during the first part of the twentieth century. Other discoveries, such as the Cañon City *Stegosaurus* in Colorado and the Niobrara State Park *Mosasaurus* in Nebraska, were made recently. Each site, however, is famous in its own right. For example, the quarry near Pleasant Dale, Nebraska, has provided fossils of some of the earliest flowering plants, and the Choteau, Montana, site is known worldwide for dinosaur nests and eggs.

Visitors try out a technique used by paleontologists to estimate the weight of living dinosaurs. In this interactive exhibit, the young visitor dunks a scale model of a Chasmosaurus into a tank of water in order to estimate the weight of the real chamosaur, whose skeleton stands before him.

MESOZOIC SITE DESCRIPTIONS

Choteau, Montana

This was the site of one of the most important recent dinosaur discoveries in North America. From a handful of small pieces of bone, Bob Makela and Jack Horner from the Museum of the Rockies recognized baby hadrosaur dinosaurs. Eventually this led to the discovery of hundreds of complete dinosaur eggs, some including embryos, and a large number of dinosaur nestlings in an area they christened "Egg Mountain."

Dinosaur National Monument, Colorado

One of the richest finds of dinosaur fossils was made in 1909 by Earl Douglass of The Carnegie Museum of Natural History. The bone beds at this site contained the intermingled remains of hundreds of individuals of eight different species of dinosaurs, all buried in the sand and silt of an ancient river.

Dinosaur Provincial Park, Alberta, Canada

More dinosaur skeletons have been collected from the badlands of Dinosaur Provincial Park in Alberta than from any other area in North America. The dinosaurs tell only part of the story, however. This site is interpreted by scientists from the Royal Tyrrell Museum of Paleontology, who prospect for microfossils, including the remains of small mammals, fish, amphibians, reptiles, and other creatures that lived among the dinosaurs around 70 million years ago.

Cañon City, Colorado

In 1992, paleontologists from the Denver Museum of Natural History uncovered the most complete *Stegosaurus* skeleton ever found. Scientists hope that this specimen will solve the mystery of exactly what this dinosaur looked like when it was alive, since the thin bony plates above its spine were preserved nearly undisturbed.

Glen Rose, Texas

Roland T. Bird excavated this famous dinosaur footprint site for the American Museum of Natural History in 1940. One trackway showed a carnosaur that appeared to be following a large plant-eating dinosaur. This particular trackway demonstrated that dinosaurs could walk on land and that they walked with their feet close together like elephants, not with their legs sprawled out to the side like lizards or crocodiles.

Niobrara State Park, Nebraska

During much of the late Mesozoic, this site was covered by a shallow inland sea. In 1989, a tree-planting crew noticed fossil bones sticking out of a hillside. These bones turned out to be the remains of a spectacular marine lizard, called a mosasaur.

Pleasant Dale, Nebraska

At the beginning of the Mesozoic, most of the world's plants were ferns, cycads, and conifers. Deposits in Nebraska and Kansas from the late Mesozoic contain some of the earliest occurrences of flowering plants, or angiosperms. One specimen found near this site is a five-petaled flower that is one of the oldest fossil flowers in the world.

Trinidad, Colorado

Kirk Johnson from the Denver Museum of Natural History is testing evidence that the extinctions of dinosaurs and other animals and plants at the end of the Mesozoic may have been caused by an asteroid that collided with the Earth. The scientists found evidence in a layer of clay in the rocks along a highway south of Pueblo. The presence of the heavy metal iridium in this clay gives a clue to what may have been one of the most catastrophic events of all time.

THE EXHIBIT

As visitors approach the exhibit, they first see a map of North America. Graphic icons indicate the locations of the eight different excavation sites. With a trackball, the user can move a cursor over each of the icons; a label then appears, giving the name and location of the site.

Some of the most important fossil finds from the "Age of Dinosaurs" have been made in the Rocky Mountains and Great Plains areas of western North America. This exhibit highlights eight fossil dig sites from the Mesozoic, 250 million to 65 million years ago. Each dig site was a scientific first, contributing important new findings about plants and animals that lived at that time. Background information on the dig sites shown on this map is provided on the facing page.

When the user clicks on a site icon, a new image appears, showing a photograph of the excavation and buttons that give the options INFO, GAME, MOVIE, QUIT. When QUIT is pressed, the screen returns to the main orientation map.

Title screen for the Choteau site, showing one of the many remarkable fossil dinosaur nests found by paleontologists in central Montana. Users may read some text about the site, see a video of an excavation, play a game, or go back to the main map.

Site Background — The interface is primarily graphic. Users mostly see pictures; when they want text, they can request it, using the INFO button. (Within this button, users can request the rules for playing the game, and they can also see the movie and production credits.) A visitor requesting information after viewing the Choteau excavation will see this text:

When the INFO button is pressed on the title screen, this text appears. Additional information is provided on each of the discussions portrayed in the Choteau exhibit game.

Visual Background on the Sites — A click on the MOVIE button produces a title screen, and then a short video with narration, captioned for the hearing-impaired, is played. Each segment lasts a total of three to four minutes, and the user may pause or discontinue the movie at any time. Each video tells a story about the excavation of the site.

- *Cañon City*. The user sees a U.S. Army Chinook helicopter lift into the air a large segment of a *Stegosaurus* wrapped in a plaster jacket.

- *Dinosaur National Monument*. Black-and-white video from the 1920s shows fossils carried by horse-drawn wagons and the use of dynamite explosions to uncover fossils in whole hillsides.

- *Niobrara State Park*. The video moves from field to lab to view specimens under an electron microscope.

- *Trinidad*. Animation re-creates the events surrounding an asteroid that crashes into the Earth. Later, scientists locate and investigate the remains of the asteroid in a narrow band of sediment containing the rare element iridium.

At Trinidad, visitors can click on each layer of stone to see reconstructions of events that occurred when that layer was deposited.

Most of the videos came from research excavations that had been recently conducted by museum staff members; the others came from historical archives. The Denver Museum of Natural History's video production unit documented and filmed the excavation of the *Stegosaurus* at Cañon City, the discovery of an iridium layer at Trinidad, and a re-creation of the mosasaur excavation at Niobrara State Park.

Learning More About the Sites — When the user clicks on the GAME button, a computer simulation unique to that site appears.

- At Dinosaur Provincial Park, users can re-create a Mesozoic environment with small dinosaurs, crocodiles, gars, and early mammals. Clicking on microfossil icons brings forth images of the animals that once lived at the site; clicking on plant icons brings forth the common plants of the period. Visitors can move the plants and animals around against a background scene, creating herds of dinosaurs and filling a lake with prehistoric creatures. This activity teaches users how scientists use microfossils to learn about the communities of organisms that lived in ancient times.

At Cañon City, when visitors click on GAME, they have the opportunity to construct a Stegosaurus skeleton and then check the accuracy of their work.

- At Cañon City, users can act as paleontologists. After completing their skeletons they can then see how their creations compare to a scientist's reconstruction.
- At Niobrara State Park, visitors can click on reconstructed images of life in the great inland sea. When they click on a square of open ocean, they can see the microscopic algae that help scientists determine the age of giant marine fossils. The tiny fossilized algae can then be magnified up to 10,000 times to see the variety of their shapes and sizes.
- A click on the Trinidad icon allows visitors to move across layers of stone to determine the events that occurred when each layer was deposited. When the arrow points to the layer of clay containing iridium, viewers can see reconstructions of how the impact event might have looked, including images of dinosaurs being smothered in dust. At another layer, the picture shows an early mammal on a forest floor.
- At Pleasant Dale, visitors can use a computerized trowel to uncover fossils of some of the earliest flowering plants.
- A click on the Choteau icon allows visitors to choose among three different dinosaur nests and then see renditions of the dinosaurs and their parental care.

At Dinosaur Provincial Park, users re-create a Mesozoic environment. Clicking on microfossil and plant icons brings forth images of the animals and plants that once lived at the site. Visitors can duplicate and/or move the organisms around, creating an original scene of the life during that period.

At Niobrara State Park, visitors can explore how tiny creatures help scientists determine the age of giant fossils. When they click on a square of open ocean, they can see tiny microscopic algae and magnify them up to 10,000 times.

Reconstructions of the nests of three species of dinosaur found at the Choteau site in Montana. Each nest was made by a different kind of dinosaur, having its own approach to raising babies. In the game, the user guesses what kind of dinosaur made a particular nest.

Users click on the box around the shallow nest with the eggs pointing toward the center to see a picture of the dinosaur *Orodromeus*. Babies probably left the nest soon after hatching, rather like present-day chickens or pheasants.

- At Dinosaur National Monument, users can click on the bones in the bone bed to see what part of the dinosaur each one came from.
- Users exploring Glen Rose can see an animation of the famous trackway and view a reconstruction of how it might have been laid down. They can also create their own trackways, using the tracks of two kinds of dinosaurs.

HARDWARE

The exhibit was developed for a Power Macintosh 8100, using Macromind Director 4.0. It is designed to operate using a trackball and button, which emulates the standard Apple mouse. A trackball rather than a touch screen was used because previous experience has shown the former to be more durable and to require less maintenance. At the University of Nebraska State Museum, the exhibit is set up using a dual monitor system with a 14-inch screen for the primary users and an upper 20-inch screen for larger groups. This arrangement facilitates social interaction among users, allowing entire groups to observe and operate the exhibit. One of the units is set into a part of the gallery that simulates a fossil "aquarium," containing original fossils of many of the giant creatures that lived in the Mesozoic inland sea. The specimens are set into the walls and floor of the entire gallery. Visitors can walk over and under glass-covered, neon-lit fossils of ancient fish, invertebrates, and one of the largest pleisiosaur skeletons on record. Another multimedia unit is built into a re-creation of a *Triceratops* dig site, and it is visible to viewers seated on a multitiered bench, making the exhibit accessible to entire classes or other large groups of visitors.

FORMATIVE EVALUATION

An essential part of the development of the multimedia exhibit involved formative testing of the exhibit prototypes. All of the computer simulations were first developed as working prototypes that were evaluated by a focus group of children and also by two groups of staff members: "novice" users, with little computer or subject-matter expertise; and "expert" users, those with extensive multimedia and content knowledge. After each of two phases of evaluation, the simulations underwent modification and retesting until problems were resolved.

The eight focus-group members ranged from 7 to 16 years of age and were balanced by gender and race. All but one disabled female had a museum affiliation, either as a member of the Junior Curator's Club or as offspring of staff. We received written informed consent from both the children and their parents, as required by the University of Nebraska's Institutional Review Board (IRB). The IRB ensures that all research and evaluation being conducted at the university, including the museum, follow appropriate guidelines for the protection of human subjects.

Subjects were first asked to manipulate the simulations and view each of the eight videos in the presence of the evaluator. Subjects were observed and then interviewed about their responses to both the simulations and the video segments. The simulations were tested for the interface functions, the use of various on-screen buttons, the ease of use of the trackball, and the overall appeal of the program. As to the videos, subjects were asked for their responses to the narrator, their recognition of elements of the content, and whether they found the video interesting and clear. An example of a portion of the initial interview with an African-American fifteen-year-old girl (FC) follows.

Evaluator: Let's start with this thing (*points to trackball*). Do you know what it is?

FC: Mouse.

Evaluator: Go ahead and touch it. Can you tell me what it does?

FC: (*Moves the point around the screen.*)

Evaluator: Move the arrow around the screen. What do you see?

FC: Little picture, move pointer, and it tells you where it is.

Evaluator: What else do you see?

FC: Map and a question mark, lower left-hand corner.

Evaluator: Map of?

FC: The United States.

Evaluator: Can you locate Nebraska?

FC: (*Moves arrow to Nebraska, moves it around the outline of Nebraska.*)

Evaluator: Why is that area on the map (*points to it*) a different shade?

FC: It's Middle America.

Evaluator: If you like, push the button on either side and see if anything....What does the question mark mean?

FC: Help.

Evaluator: What does GAME mean?

FC: Play game on Pleasant Dale.

Evaluator: What does MOVIE mean?

FC: There will be a short movie about that place.

Evaluator: Move to the QUIT button. What does it say, what will it do?

FC: Quit, take you out of the game. (*She quits the game, returns to map screen.*)

Evaluator: Try the MOVIE button. This button is still in development, so when you press the button, I will turn on a movie. (*She runs about two seconds of movie as an example.*) As soon as you want the movie to stop, press the button again. Now, move the arrow around and try other things.

An important aspect of the design was to make the interface intuitive. We wanted to know whether users could figure out how to play the games without having to read instructions. The subjects' grasp of the intuitive elements of the program is shown in the following examples of two game users at different sites.

- **Child, age 7** (Cañon City): I see dinosaur bones...what thing do I hit? (*She clicks on MOUNT.*) It's moving...the bones...it's coming!

(Dinosaur Provincial Park): Now what do I do? (*She clicks on bottom plant box.*) Oh, my God! You make stuff! Look, I'm making my own little...that's a tree, that's a flower...(*She clicks on marsupial box, then clicks again so that it disappears.*) I took it away because that's not what I wanted. I'm kind of creating what the dinosaur was like before we even seen it.

(Glen Rose): (*Child clicks on bottom box.*) Now I'll experience what it does...come on...(*The tracks are slow to appear.*) Wow! (*The evaluator asks what she saw.*) I don't know what it is. (*She clicks arrow on top box; first tracks disappear.*) Hey! This is how you make everything disappear.

- **Child, age 15** (Cañon City): (*After completing the Stegosaurus*) How am I supposed to know if I did it right? (*She clicks on MOUNT.*) Oh, you push on MOUNT and it shows how it exactly goes together.

In this program, text and instructions are available through the INFO button, but well-designed games should require minimal reliance on instructions. Adult subjects frequently read the instructions, even when they had already figured out how to play the game. They seemed to want external verification that they were performing correct actions. Children, on the other hand, rarely needed or requested the instructions.

The main context of the game needed to be obvious to all users. The evaluator determined whether users knew that each of the games and movies referred to specific excavations in North America. It was essential that the activities be connected in users' minds to real places and real science. It was equally important that the games be fun and that people were motivated to play them without being told to.

The evaluator examined many detailed aspects of the design of the program and assessed how easy the program was to use. She looked for consistency of function in the buttons so that on-screen buttons in similar locations performed similar functions. She looked for how well buttons would be recognized and found that subjects allowed for much latitude in what constituted an on-screen button. For example, a square drawn around a giant marine reptile or around a nest site was recognized by the subjects as an object that required activation. However, she found that it was vital that functions, such as speed of response and the system for clicking and dragging objects, were consistent throughout the exhibition.

The most popular simulations were those that allowed the subjects to create something new of their own. For example, subjects preferred the simulations where they could build on-screen dinosaurs from their skeletal components or design on-screen "environments" from available plants and animals. In the microfossil simulation, the children could create any scene they liked, or — as they all did — they would stack the animals and plants one on top of the other like a ladder or create bizarre and unrealistic arrangements. In the *Stegosaurus* game, after the first pass at building it, they would return to it again and again, each time trying to complete it faster than before. Overall, the children were strongly interested in the exhibition content and in learning more about dinosaurs and other events of the Mesozoic Era.

THE CONSORTIUM REVIEW

The consortium partners reviewed the exhibition at two stages. Early on, they reviewed the edited videos, and later they reviewed a videotape of the entire exhibit that walked through each of the simulations. Videotape was used as the medium for the partner reviews because not all of the partners had the appropriate hardware conveniently available. Most responded promptly by E-mail with corrections, clarifications, stylistic suggestions. Some partners suggested expansions of the simulations that were not ultimately used in the exhibit, but overall, most of the feedback was incorporated into the final version.

CONCLUSIONS

Multimedia can provide an active role for the people behind science museum exhibits. No longer are scientists the silent voices behind static museum copy. Their activities and personalities have become integral parts of the experience of viewing artifacts. Real women and men struggle, joke, and puzzle their way through research that answers fundamental questions about the natural world.

Multimedia has several advantages over more traditional exhibits. Researchers have good evidence that multimedia exhibits attract more visitors than other kinds of exhibits (Koester, 1993; Diamond, 1989; Hilke et al., 1988). As pointed out by Woolsey and Semper (1991), multimedia has specific advantages: it can facilitate social interactions; it can be a multimodal experience, providing a mixture of real images, models, sounds, and tactile sensations; and it can turn over control of learning over to the visitor.

Collaboration gives museums the opportunity for a wide range of multimedia options. In this project, collaboration gave the project access at no cost to high-quality video animation, original film footage of famous dinosaur excavations, historical video footage, and original works of art. Added to this was a range of tools that would give visitors opportunities to learn in a variety of different styles and modes. Access to images permitted the development of entirely graphic interfaces, so that text information was available only on demand. This makes the exhibit accessible to the widest possible audience since reading is not a prerequisite for its use.

This project shows one example of how collaboration among museums created a multimedia exhibit that was individualized for each institution, while at the same time useful to a wide range of viewers. By working together, museums are able to come closer to realizing the full potential of this powerful medium for teaching and learning.

ACKNOWLEDGMENTS

We wish to thank the National Science Foundation's Informal Science Education Program and the University of Nebraska for providing funding for the project. We would also like to acknowledge the valuable participation by many individuals on the staff of the six consortium institutions. Thanks to David Watkins for the photograph of microscopic algae; to Kirk Johnson for the original photograph of the deposit at Trinidad; and to Douglas Henderson for the depiction of an *Orodromeus* mother at her nest in the Chateau site. In addition, there were several individuals at those institutions and others to whom we are particularly indebted. These include Jim Farlow, Marc Marcuson, David Baysinger, Bonnie Saccatello-Sawyer, Peggy Bolick, Mrs. Roland T. Bird, Mike Voorhies, and David Dilcher. We would also like to acknowledge the valuable assistance of the staff of the Interactive Media Laboratory of the University of Nebraska and the staff of the Interactive Media Group of Nebraska Educational Telecommunications. All photographs of on-screen images in this article are by Jill Koelling; gallery photographs are courtesy of the Nebraska Game and Park Commission.

REFERENCES

- Diamond, J. (1989). "Desert Explorations — A Videodisc Exhibit Designed for Flexibility." *Curator* 32/3: 161–173.
- Hilke, D.D.; Hennings, E.C.; and Springuel, M. (1988). "The Impact of Interactive Computer Software on Visitors' Experiences: A Case Study." *ILVS Review* 1/1: 34–49.
- Keizer, G. (1994). "Multimedia Exhibits Attract a Crowd: Museums Get Down to Business." *Multimedia World*, May: 92–93.
- Koester, S.E. (1993). "Interactive Multimedia in American Museums." Archives and Museum Informatics Technical Report Number 16: 1–120.
- Woolsey, K., and Semper, R. (1991). "Multimedia in Public Space." In D. Bearman (Ed.) *Hypermedia and Interactivity in Museums*. Archives and Museum Informatics Technical Report #14: 46–52.