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# An Interactive Bronc-Riding Exhibit Bucks Convention

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## **Abstract**

This describes the usability and interaction challenges in designing and installing a unique, technology-enhanced museum exhibit which had to be innovative as well as simple to use and maintain.

In the Bucking Bronc exhibit at the National Cowgirl Museum and Hall of Fame, visitors ride a mechanical horse and are recorded on digital video. This video is then composited into old newsreel footage, and the resulting clip is played back. The visitor receives a printed ticket with login and password, with which the ride can be downloaded from the museum's web site. This takes place in a museum in which neither staff nor visitors are particularly technologically savvy.

## **Keywords**

Concept Design, Design Planning, Experience Design, Graphic Design, Interaction Design, System Design, User Experience, Museum, Bronc, Cowgirl, Macintosh, Digital Video, Compositing, Greenscreen, Web, Quicktime, Internet, Automation

## **Industry/category**

Entertainment, Education, Museum, Installation, Exhibit

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### **Project statement**

The National Cowgirl Museum and Hall of Fame opened in June 2002 in Fort Worth, Texas. It is located in the city's Cultural District, which includes world-class art museums as well as livestock arenas.

The museum's permanent exhibition space was designed by West Office Exhibition Design, and I teamed with them to produce several audiovisual exhibits. The museum's overall mission is to immerse visitors in the culture, history, and spirit of the cowgirl, and the exhibits include stories, artifacts and images, utilizing various media.

The exhibits are divided into three general themed galleries, titled *Into the Arena*, *Connection to the Land*, and *Pop Culture*. The first gallery tells the stories of cowgirls in rodeos and "Wild West Shows." This details such activities as barrel racing, calf roping, "cutting" (a calf from a herd while on horseback), stunt riding, trick shooting, and bull and bronc riding.

Rodeo cowgirls, both living and historic, have led particularly compelling lives, and there exists exemplary film footage of them in action. Other exhibits in this gallery contain displays of rodeo arena fashions, photos, or video of cowgirls telling their stories.

For this exhibit, the goal was to give visitors the feeling of being astride a bucking bronc in a real rodeo arena. Sub-goals were to show some historic rodeo footage, and to have real cowgirls demonstrate how to ride a bronc properly.

Real rodeos and livestock shows are held in arenas adjacent to the museum, and museum visitors tend to come from rural areas; they are generally more comfortable around cattle than computers. This also holds true for the museum staff, many of whom are themselves authentic cowgirls. The museum does not have an audiovisual technician. Thus, any technology in the exhibits had to be simple and intuitive for visitors to use, and easy for museum personnel to update and maintain.

### **Project participants**

The exhibits were designed by West Office and fabricated by Maltbie Associates. Audiovisual hardware was installed by BBI Engineering. Daniel Cummings did the bulk of the Bronc programming (in Macromedia Director), and Herbert Diamant modified his f3 Quicktime-editing Director Xtra (plug-in) for us. I oversaw the project, designed the computer interface, programmed the video compression and uploading components, did video and audio editing, and installed the software at the museum. The museum's network infrastructure and web site (including the downloading of videos from the exhibit) was outside the scope of our work, and is handled by I.T. Partners of Dallas.

### **Project dates and duration**

I began work on this project at West Office in January 2001. Initial exhibit concepts were completed in April and developed over the next three months. Software programming and prototyping began in October, and user tests were conducted in December and January. Core programming was complete by February, and the interface and interaction design was streamlined over the next two months. Further, informal, testing was done throughout this period to refine the instructions

For the uninitiated, a "bronc" or "bronco" refers to a horse, especially a particularly lively one.

and usability. I installed the exhibit at the museum in May, and the museum opened June 6, 2001.

In the months after the opening, I did a great deal of programming to refine the automated post-processing and uploading of video.

### Process

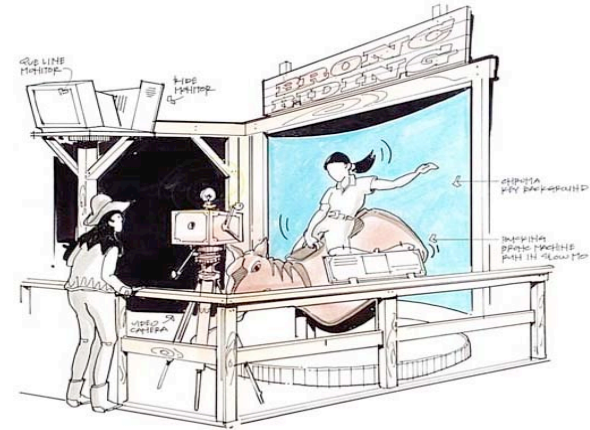
The initial communication goal of the Bronc exhibit was to provide “a fun sense of participating in a rodeo event, while learning about the origins of women riding broncs/bulls.” The *Into the Arena* gallery was to be completely immersive, surrounding the visitor with the sights and sounds of the rodeo arena. In another exhibit I produced, flashy rodeo costumes are displayed in a case, on a moving rack (as used by dry cleaners); this is controlled by a touchscreen mounted in front of the case. Another, nearby touchscreen program provides film footage and web sites about Annie Oakley.

To meet the goals of the Bronc exhibit, we decided to put visitors directly into the rodeo arena, and to put them into the old newsreel footage, as realistically as possible. We would record a visitor’s simulated bronc ride, then composite and edit it into actual newsreel footage.

Safety issues immediately came to the fore, and we decided against a motorized ride such as the mechanical bulls found in bars. We found a type of simulated bull used for rodeo training, which sits on a flexible shaft, a life-sized version of the spring-mounted playground toy. It moved under the rider’s own shifting weight, thus eliminating any electrical connections.



**figure 1.** Early storyboard of bronc exhibit.



**figure 2.** Early concept drawing of bronc exhibit.

The exhibit fabricator was able to craft a life-sized horse torso to replace the bull on one of these devices, and the cowgirls of the museum staff fitted it with a real saddle and bridle. The finished bronc was surrounded with several feet of 10-inch-thick padding and enclosed in a low, gated fence.

The horse was to be placed in front of a bluescreen for easy compositing of the rider against the newsreel footage. During the design development process, however, the museum alerted us to the fact that cowboys and cowgirls tend to wear a lot of blue denim clothing, and this could pose a challenge for compositing. We made the switch to Chroma-Key Green, or at least a reasonable facsimile, which is a very bright, tropical shade of green.

To perform the compositing, we considered using hardware solutions such as a video switcher with keying capability. This would have necessitated a

separate video source in addition to the camera input, as well as control over the two. To keep costs down, and because our software had to do several other specific tasks, we did the compositing in software, and kept the system to a single computer.

We also wanted a second monitor to play back recently-recorded rides, and this would necessitate a second video source, most likely a second computer. During the exhibit design development process, however, the second monitor was cut from the exhibit and with it the second computer. This made our programming task easier, but the museum still wanted a way for visitors to see their rides again. I proposed uploading the video clips to a web server for visitors to download later.

I contracted with Daniel Cummings, who had experience in prototyping complex interactions between specific hardware and Macromedia Director, our authoring software of choice. He also lived nearby, which made collaboration easy.

Together, we had created another exhibit for the museum, in which visitors are photographed and automatically composited into an old movie poster. In that case, the compositing is done in real time, so that visitors can position themselves in the poster for the best composition. We used a Director Xtra created by our New York University colleague, Daniel Rozin, which allowed us to key out particular colors in the video feed and replace them with a new background graphic.

This did not allow compositing two live video streams, however, and we could not locate another Xtra that accomplished this. We suspected that it might be

possible with Max (multimedia software from Cycling74) but neither of us had had much experience with that program. We then researched the options for post-processing the compositing, and discovered that this capability is built into the Quicktime architecture, but it is little used. We located a video Xtra created by Herbert Diamant which tapped into low-level Quicktime functionality, and hired him to customize his Xtra for our purposes. He too happened to live nearby, and the three of us were able to have regular meetings at West Office, which was centrally located for all of us.

In addition to color-keying, the video clip would have to combined with other clips to create a complete story. With West Office designers, we decided that the finished video should intersperse close-ups of the visitor with long shots of a real cowgirl on a bucking bronc, from the newsreel footage.

Together, we identified several discrete steps that the software had to perform:

- Display a live video feed of the visitor
- Capture x seconds of video when prompted by the visitor
- Key out the greenscreen background
- Insert a second video track with the new background
- Edit the composite clip into a sequence long shots from old newsreel footage
- Insert an effects track to make the clip monochrome and grainy
- Add a soundtrack
- Play back the completed clip once
- Upload the clip to a web server

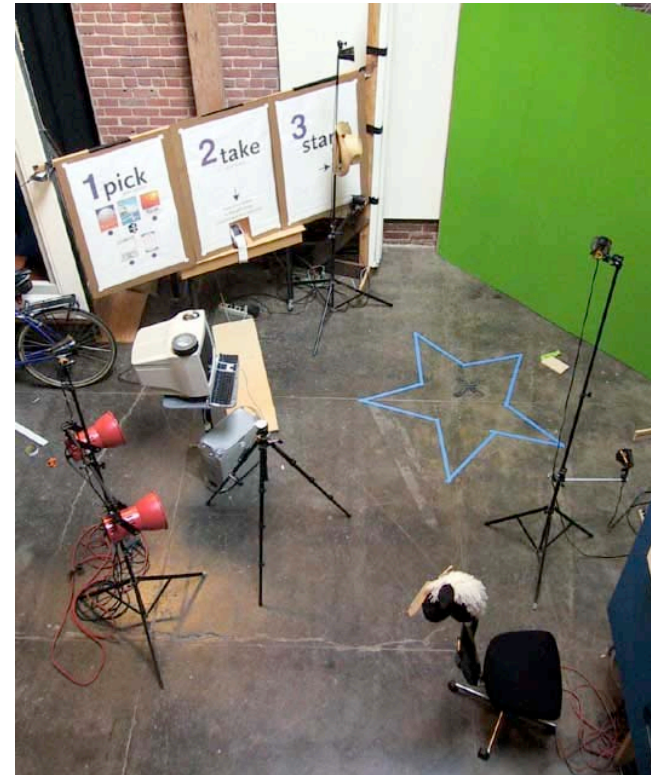
Danny Rozin is best known for his *Wooden Mirror* installation.

His Xtras can be found at <http://www.smoothware.com>

This not only served as a linear sequence of events, but it separated Dan's programming tasks into discrete chunks; overall, it also served as a complete scope of work for his part of the project. We knew that he would be moving across the country soon, and would not be as readily available for meetings or fixes. Over the next three months, he coded each step separately, and we tested and refined each before putting them all together.

Before he moved, we sat down and he walked me through every line of code, knowing I would inevitably have to make changes during the design or installation process. I have been programming in Lingo (Director's authoring language) for about ten years, but tend to do things as simply, and with as little code, as possible. Dan, on the other hand, often re-uses code. This makes coding new projects easier, but necessitates a bit more code to make it more generalized. This caused me some anxiety when trying to debug things on-site at the last minute, but in the end his code was rock-solid, and I learned a great deal from it.

As each component was coded, we tested it extensively and debugged as needed. When we had a fully-functional version of the software, with placeholder images and audio, we began user testing. West Office is fortunate to have a large space in a former warehouse, and we built a full-sized mockup based on the exhibit drawings. This proved invaluable for refining the interaction, instructions, and general visitor flow. We started testing informally with West Office employees unfamiliar with the exhibit, then scheduled formal user tests, with children comprising the largest group.



**figure 4.** Mockup for Poster and Bronc exhibits at West Office

### **Solutions**

The testing, as well as the museum's directive, mandated that visitor interaction with the technology should be as simple as possible so as not to detract from the immersive nature of the exhibit. We considered various sensors and such to determine that a rider had mounted the bronc. But the user testing prompted us to give the user control over when they were ready to begin the experience. So a simple push button was decided upon.

This proved more difficult than it sounds. Wires could not be run through the flexible center shaft in the bronc, and placing a button anywhere else was not preferable, since we could not determine how long it would take the user to mount the bronc, or whether or when they would be ready once in the saddle. Small children had to be helped into the saddle by parents, and this often took longer.

The exhibit fabricator found a way to wirelessly transmit the button closure to a show controller (which is wired to the computer) – a simple, household garage door opener, which uses radio frequency technology. The button was able to be placed in the most desirable location, near the user’s hands, in front of the saddlehorn. A deep-cycle marine battery will keep it operational for several years.

Unfortunately, due to construction delays, this final piece of the puzzle was not installed until the night before opening. As it was hastily being hooked up, a crossed wire sent 110 volts of electricity through the entire system, rendering the show controller, computer, and camera completely useless. It was sheer luck that we had a spare computer and show controller on hand, and were able to find an identical DV camera at a local electronics store. (A very small camera was required to fit into the housing, which is designed to look like an old film camera, but we also required manual control of focus, exposure, and white balance. We used a JVC GR-DVP3u.) The exhibit opened only a couple of hours late.

We tested as many of the interconnected pieces as possible in our mockup. Unfortunately, there were a few others we could not control. For example, although

the button was on the horse, directly in front of the rider, it was often missed. Our on-screen instructions originally read “Saddle Up! Press the button to record your ride.” This was changed to “Saddle Up! Press the button near the saddlehorn to record your ride.”



**figure 5.** Completed bronc, installed in the exhibit.

Despite this correction, we found that visitors often fail to read instructions at all. This is a longstanding problem in museums [1]. Despite the fact that a large monitor directly in front of them displayed clear instructions, in large type, many people simply mounted the bronc and then wondered what to do. There are aural cues, but not until the button has been pressed. Some visitors are content merely to sit atop the bronc and see themselves on the screen; they do not seem to notice the instructions placed above and below the live video feed on the screen. Instructions are also printed on a graphic panel at the entrance to

the exhibit, but these are usually overlooked as well, most likely because the full-sized bronc in front of a bright green screen seems to draw most of the visitor's attention.

The button press initiates recording, but this fact was often lost on the rider, since the live video feed did not change from its "paused" state. After user testing, we inserted a three-second countdown on-screen, accompanied by a mock rodeo announcer welcoming the next rider, during which the live video feed is turned off. The countdown numbers are bright red on a black background and animate to fill the entire screen, for maximum visibility.

During the ride, a smaller countdown appears next to the live video window to indicate how much recording time remains. Standard video commands, "paused" and "recording" also appear on-screen, in iconic and written form.

Many visitors also expected the bronc to move by itself, so we had to add instructions during the ride telling them that it moved only under their own weight.

Once the ride is recorded, it takes some time for the computer to chroma-key, composite, and edit the video into the newsreel footage. For a 10-second ride this can take up to 30 seconds, even on the 900MHz G4, the fastest Mac we could get at the time. So during this time we display instructions to the effect that the user should stay seated until their finished clip is ready. (We also use this time to tell the visitor that they can access their clip on the museum's web site.)

To maximize visitor flow-through, it would have been desirable to have them dismount while the next rider prepares. But we decided that this was a small price to pay for the risk that the rider might miss his/her ride while exiting.

The loss of the second, playback, monitor, and the decision to upload video clips to the web necessitated major changes. Privacy and security concerns required a way for visitors to access only their own ride. So after the finished ride plays back once, we print a small receipt containing a login and password, as well as the web address and a thumbnail-sized image from the ride. We placed the printer near the exhibit exit, and display instructions on-screen to take the printout as they leave. (We use Herb's Xtra to grab a frame from the Quicktime movie. The username is constructed from the filename and number, and I wrote a simple random password generator. All this is printed printed from Director using the Print-o-matic Xtra.)

The printout was hampered by the same problem as described above – although displayed prominently, the instructions were often missed altogether, and the visitor neglected to take the receipt. Visitors also tended to try to exit through the same gate as they entered through, despite clearly marked entrance and exit signs. This was mostly due to the highly immersive and physical nature of the exhibit – after moving the bronc around for several seconds, often in front of spectators, the visitor inevitably wound up laughing so hard that the last thing s/he wanted to do was look at the screen for instructions.

To address this, I added a giant arrow to the on-screen instructions, pointing to the location of the printer and

the exit. Another large, yellow arrow graphic was mounted near the exit gate, above the printer. And the sound and movement of the receipt printing out tended to draw the visitor's attention to the right place.



**figure 6.** Modified ticket-taking instructions on screen .

Other aural cues provide other, subtle, prompts. The sound of a bucking bronc plays during recording, and contemporary music plays when recording ends and the video is being processed. When the finished ride plays back, the music changes to vintage newsreel-style music, accompanied by a news announcer. All audio stops after playback, and the sound of the receipt printing can be heard.

The printer itself was another technical problem. We used the Dymo Labelwriter 330 Turbo, which is primarily intended for printing adhesive labels. With an inexpensive roll of receipt paper, it prints quickly and with very high quality. However, it was not made for constant, heavy use – the paper feed mechanism, and the communication with the computer, often jammed.

It also does not have an auto-cutting mechanism. During the first few opening days, a museum volunteer remained near the printer to clear paper jams and tear receipts off for visitors. (The same printer was used at the poster exhibit, resulting in the same situation.)

Communication jams (and other computer problems) were most easily fixed by rebooting the computer; to make things easy for the museum, my first tip for troubleshooting was to simply press the reboot button on the computer – Macs withstand this much better than PC's, and I set up the OS and software so that the program would launch properly on startup. We switched to an Ithaca PosJet 1000 for printing receipts, trading print quality for hardware durability, as well as an auto-cutter. It eliminated the printing problems.

This did not, however, solve the massive headaches involved in getting video clips onto the web server. This seemed a simple task, and initial tests looked promising. We tried to keep all of the software tasks inside the Director environment, and used the DirectFTP Xtra to move the Quicktime files to an FTP server.

The uploading would take place after the museum was closed, and we calculated that if the exhibit was in constant use all day, eight hours would be more than enough time to upload all of the day's movies. Dan wrote some nice code that triggered the uploading at a specific time of day, and he included some error-checking routines to allow for network delays and corrupt files; if any files remained to upload the next morning, they would be included in the next night's batch. During exhibit operation, the bronc program generates a list of usernames and passwords



**figure 7.** Frames from completed clip.

associated with each video clip, and this list is also uploaded to the server.

To minimize video processing time during exhibit operation, we offloaded audio playback to the show controller – sending an ASCII character out the serial port was a lot faster than adding a soundtrack to a movie. This worked well, with no delays in synchronization (thanks to reliable BBI show controllers). But we then had to add the soundtracks to the movies before uploading. Thanks again to Dan’s programming, this worked flawlessly.

But the DirectFTP Xtra did not behave reliably, freezing or crashing for unknown reasons. In addition, the museum deemed that the files we were uploading (about 4MB each) were too big to be downloaded by visitors, many of whom had low-bandwidth dial-up connections. Therefore, we had to compress the movies before uploading.

Dan was, by now, across the country at a new job, and the museum was open. I took on this task myself, and wrote an Applescript which ran the movies through Quicktime Player, compressing and exporting each one, then uploading to the server. I was able to work from some excellent Applescripts written by Steve Godun, for Mac-based exhibits we had created at the American Museum of Natural History. Ultimately, this worked well, but it took several months to perfect.

### Results

The final Bronc exhibit works as follows: As visitors approach the exhibit, the horse stares at them from its sea of blue padding. The monitor, as an attract loop, silently shows the last ten rides, with text

superimposed which says, “Saddle up! Hit the button on the saddlehorn to record your ride!” Along the railing near the entrance, graphic panels tell how to ride a bronc properly.



**figure 8.** Final bronc exhibit in use.

When the visitor mounts the bronc and presses the button, a rodeo announcer (actually my voice slightly altered) announces, “Here’s the next rider!” This audio comes from the direction of the monitor, which displays a large countdown, then shows a live video feed of the rider. Text on-screen instructs, “Buck the bronc! It does not move on its own.” Text and an icon indicate that recording is in progress, and this accompanied by the sound of a crowd and a snorting, bucking horse.

After ten seconds of recording, contemporary Western music plays, and the video feed on the screen is replaced with a static screen which says, “Hang on to

see your rodeo newsreel!” with smaller text which says, “Download your ride at [www.cowgirl.net](http://www.cowgirl.net).” After about 30 seconds, old-time country music plays as an announcer narrates the completed newsreel.

After the clip ends, the screen says, “Take your ticket to see your ride again on the web,” again listing the museum’s web site. An arrow points to the printer, which is printing the ticket containing access information and a thumbnail image. The screen then goes back to the live video feed, ready for the next rider, and after five minutes without a button press, goes to the attract loop.

Every evening, a script runs which adds soundtracks to each movie, compresses each, then uploads it to the museum’s FTP server.

Over the past eight years, I have created many technology-enhanced museum exhibits, in a wide range of scale and scope. I have adopted many practices over the years to make such projects go smoothly, and try to apply the lessons I have learned. In this project, we did all the things we should have done – allowed ample time for programming and debugging; tested with real people in a full-size mockup; maintained a web-based project management scheme which (literally) kept all participants on the same page; kept to a contained budget and scope of work, with clearly delineated responsibilities; and were able to design the exhibit collaboratively, from the start.

The major problems with this project, as with many, were unforeseen, or beyond our control. Construction delays prevented us from testing all of the parts together, well in advance and over extended periods of

constant, heavy use. We were able to test with the final computer, camera, and printer ahead of time, but should not have been afraid to use too much paper in testing the Dymo printer.

In any such project, I try to prepare for major course changes mid-stream, and to allow for unforeseen consequences when all of the parts work together, and interact with other parts in the final installation. We were able to change printers on short notice. But the compression and uploading aspect came about late in the project and could not be tested adequately before deployment.

Fortunately, having finally perfected this process, we have created a unique, immersive experience in which the technology is not only mostly hidden from visitors, but works automatically and without maintenance by the museum. It is an unprecedented interaction between an installation and web-based experience, and it will form a good foundation for future such projects.

Having worked primarily on science museum projects in the past, this type of museum was new for me. It turned out to be an incredibly fulfilling and emotional experience. Not only was cowgirl culture and history endlessly fascinating, but during the opening weekend, the museum was filled with real cowgirls whom the museum had inducted into its Hall of Fame. Several of the exhibits prompted tears of pride and joy. The Bronx, on the other hand, never fails to elicit raucous laughter from both rider and spectators. It is a great pleasure to have created something with such power.

### **Acknowledgements**

Without Allison Walker (my wife) managing the entire exhibition, we would have foundered; she was also very patient during the month I spent in Fort Worth, installing software. The museum's cowgirls, notably Debra McStay and Mary Etta Cochrane, were also patient as I tried to debug the uploading process. West Office created a fun, informative, and innovative exhibition. Hired hand Ra Byn Taylor was priceless on-site for installation and troubleshooting, and Mac guru Steve Godun provided valuable advice from afar. Bronc-riding music was provided by Gerhard Schlansky

(a fine exhibit designer in his own right and one of my old co-workers at the American Museum of Natural History). Additional banjo tracks were done by the Cowgirl project's head exhibit designer, Steve Tornallyay.

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