

**THE EDGE OF THE ILLUSION:  
A Virtual Reality Production of “The Magic Flute”**

**By Mark Reaney, Delbert Unruh, and Stephen Hudson-Mairet**

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# the **EDGE** of the **ILLUSION**



PHOTOS BY STEPHEN HUDSON-MAIRET

Figure 1



Figure 2



Figure 3

a virtual reality production of

the

FLUTE

FLUTE

by Mark Reaney, Delbert Unruh, and Stephen Hudson-Mairet

Mark Reaney and the Institute for the Exploration of Virtual Reality—IE-VR—are known nationally and internationally for research into and development of real-time computer graphics in a live theatre environment. At Mark's suggestion the University of Kansas Theatre scheduled Mozart's *The Magic Flute* for production in the spring of 2003. The previous IE-VR productions of *The Adding Machine*, *Wings*, and *Tesla Electric* were well known to the other members of the production team; so, it was with a sense of exhilaration that we all signed on and began our exploration of the opera. Involved in this production were Mark Reaney (virtual reality and scene design), Delbert Unruh (direction), Ione Unruh (costume design), and Stephen Hudson-Mairet (lighting design). The overture video was produced, directed and edited by Matt Jacobsen.

#### PRELIMINARY ANALYSIS

The great strength of this 1791 opera for audiences in 2003 is its basis in fantasy. Prince Tamino is on a quest. His goal is to rescue Princess Pamina who is being held captive by Sorastro, an Evil Magician. On his way to fulfill his duty he acquires Papageno, a comic and earthy sidekick, who only wants to find a wife and have a family. At the beginning of Tamino and Papageno's journey their benevolent benefactor, the Queen of the Night, gives them magic powers—the flute and the bells—and mysterious guides—the Three Spirits. As the journey continues, Tamino and Papageno are separated, undergo various experiences and trials, and emerge victorious at the end. Papageno and Papagena run off to have babies. The Queen of the Night's assault on Sorastro's Kingdom (The Queen turns out to be bad and Sorastro turns out to be good.) is thwarted.

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Tamino and Pamina survive the Trials of Fire and Water, attain wisdom, and are simultaneously married and crowned as rulers of Sorastro's Kingdom—happy ending.

*The Magic Flute* is a much beloved opera, and Mozart's music is transporting and transforming. However, when the production team first began considering virtual reality options for this production, we had to confront two large non-musical problems. The first, paradoxically, was the fairytale quality of the piece. *The Magic Flute*, and the legions of similar plays and operas that preceded and followed it, have established the basis for many of our contemporary movies and video games. The popular media's fascination with these ancient stories when wedded to the technology of CGI (computer generated imagery) has created a base line of consciousness and expectation in the contemporary audience. Audiences are familiar with these story lines, and expect to see the fantasy environments and effects rendered in meticulous detail. We wanted to preserve the essential mythic quality of the piece, and so we began to develop the concept of "An Eternal Fairytale." This, we thought, would allow us broad latitude, would make it possible to design from the emotional/theatrical center of each event, and would allow us to add contemporary touches.

The second problem was with the text. In the original text the dialog sequences are long, weighed down with needless exposition, and, quite frankly, boring. Similarly, the sequence of scenes in Act II is unbelievably confusing. Investigation of the past production history of the piece revealed that often the dialog sequences were re-written and the sequence of scenes in Act II rearranged. Accordingly we re-arranged Act II, wrote new, short, contemporary dialog sequences, and eliminated all Masonic references. With all of this as background, we began to develop the concept in more detail.

## THE CONCEPTUAL PROCESS

As we began the conceptual process we slowly fell into, what we later termed, "The Lord of the Rings Fallacy." Computers are able to manipulate images in very sophisticated ways. As anyone knows who uses Photoshop, it is relatively easy to change photographs—errors can be corrected, blemishes removed, and colors and compositions altered. This technology can be immersive and hypnotic. In the movies, at the local multiplex or IMAX, this is precisely the effect that is wanted—total immersion. The effect is more or less successful depending upon the theatre and the film. But the aim is still the same—the audience is lulled into an acceptance of a fantastical world in which the depiction and execution of visual images can

never go wrong. Barring some catastrophic equipment failure, movies immerse us in the same way every time they are shown. That's why we go to the movies—total immersion, no mistakes. In their perfection the movies lull us into reverie. Movies are a dream, a dream in which Clark Gable says "Frankly my dear, I don't give a damn," every time, in the same way, whenever *Gone With The Wind* is shown. But in the theatre, variations in performance are a constant; and the dream of total immersion is seldom realized. In contrast to the movies, in VR production live actors stand in front of the screens on which are projected images controlled in real time by live technicians. Their essential and undeniable presence, and our connection to them as fellow human beings, means that any attempt at immersion needs to leap over the fact of their existence. So, we had a problem.

We had a powerful technology at our command. We had new computers and projectors. We could afford the right projection screens, we had Mark who knows more about all of this than probably is healthy for one human being; but all of this could only take us so far. As fantastic as it was, it was never going to be error proof or totally immersive because it was going to be performed by and run by humans every night. As we mulled the problem over we kept coming back to what we had agreed we wanted this production to be—a fantastic story, presented in a light-hearted manner, realized through contemporary technology, and happening live in a theatre. The lure of creating an immersive environment was powerful, and hypnotic; and we were drawn to it. But we were constantly brought back to earth by the realities of live theatrical production.

So our greatest potential strength, the immersive and seamless technology of VR, was also potentially our greatest weakness. Could we turn that around? At first we could not clarify this problem any further. It was just an unformed idea until Mark defined it in theatrical terms. At one of our meetings he brought in an image from the Winter Olympics in Salt Lake City. The image shows a

huge projection screen in the shape of a buffalo. On the screen is projected the images of what appear to be cave paintings of buffalo. But the real clincher for us was that below the screen you could see the feet of the skaters and the poles they are using to hold the screen up. It is a powerful image—made even more powerful when you see how it is being created. At one and the same time you see the illusion and that which creates the illusion. You see the edge of the illusion.

## DESIGNING THE EDGE OF THE ILLUSION

The edge of the illusion became our guiding idea. It would allow us to create a production using the immersive technology, but we also wanted the audience to be constantly aware that it was a live theatrical event. So we began to think how to both create and destroy the illusion at the same time. Now, this is not a new idea. Theatrical history indicates that the ancient Greeks used the same idea through the use of masks, outsize costumes and kotherni. Dramatists such as Shakespeare, Brecht, Pirandello, Beckett, and Thornton Wilder, to name only a few, based much of their dramaturgy on the tension between illusion and the reality of the theatre. In their works the illusion is exposed or destroyed at the same time it is created. The audience sees, at one and the same time, what the illusion is and how it is created. This is also the concept that informs the art of the contemporary magicians, Penn and Teller. It is also the principle executed in the breathtaking design of *The Lion King* by Julie Taymor. The edge of the illusion is a kind of game, and we hoped that if we gently invited the audience to enter into the game, they would focus more strongly on the illusion and thus make it more powerful and compelling. If the audience entered into the game willingly, we believed, they would immerse themselves.

However, using digital technologies made the practice of revealing the edge of the illusion somewhat more difficult. In

more traditional stagecraft, revealing the underlying stage technology shows the audience something that they can intuitively understand. A mask, a line and pulley or a lighting instrument are elements that when revealed illustrate the beautiful simplicity that often underlies the most wonderful stage effects. Virtual reality simulations however, are complex constructions that are created and operated within the innards of a computer. The trick then is to reveal the technology in such a way that the audience believes they are “in” on the creation of the images. They need to feel they are playing the game with us; they need to feel they “own” it.

The first step was to reveal the scene shifting mechanism and the computer and projection operators. All the scene shifts were executed by six stagehands dressed in the costumes of Mozart’s time—our *Bühnenarbeiter*s. In addition, throughout the production a computer operator and projectionist could be observed as they sat at the front of the house, between the orchestra and the audience. The VR simulations of fantastic settings and creatures were operated on the computer, as one would play a video game. By manipulating a joystick and pressing keys on the keyboard, objects could be made to move or the audience’s viewpoint could be navigated within the virtual environment. This interface was developed primarily because it was the easiest for a novice operator to control but it had the added benefit of being the most transparent technology. If the audience couldn’t grasp the inner workings of the computer they could at least understand the principles of operation.

The working of the projector was perhaps even more obvious. Our high-tech/low-tech machine consisted of a digital data projector mounted upon a shop-built follow spot-like stand. As our *Bühnenarbeiter*s moved any of the wide variety of seemingly simple screens about the stage, the projectionist simply followed them with the projected image. Zoom and focus was a bit of a concern but after a bit of rehearsal, those problems were easily resolved. This follow spot/projector was conceived as the simplest solution to the effect we wanted, but it did the double duty of bridging the gap between the impenetrable high-tech and more easily embraced traditional stagecraft.

At the beginning and several times during the production, the two main rear-projection screens were raised far enough that performers, our chorus and the upstage projection position were visible to everyone. There we could see a computer operator sitting at a table with a pair of computers and two data projectors. The first computer was equipped similarly to the FOH computer, running virtual simulations, as one would play video games. The



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second computer was set up primarily for use during the trials of fire and water sequence of the second act. Using music visualization software, abstract pictures were created from waveforms acquired from the microphones worn by the performers. These colorful, abstractions were made to flow across the screen in reaction to the singer's voices, pitch and volume creating splashes of color and movement.

In addition, there was a projectionist standing behind another follow-spot style projector connected to a video camera for special effects involving characters, images of who were projected in superimposition over the computer generated graphics. These technical positions were located so far upstage that the audience did not easily see them in detail. However, the mere fact that they were visible and visibly linked to the effects they created allowed their function to be readily understood.

The last projection set up consisted of two 35mm slide projectors located offstage right and left. These projectors were each focused across stage on tall screens that flanked the stage on either side in a tormentor position. These projections did not carry much weight of the scenographic storytelling but were instead merely responsible for filling in the visual space on either side of the proscenium. It was not practical to have these projectors and their operators visible on the apron so instead we opted to reveal the edge of the illusion by having the tormentor screens mounted on traveler tracks. During the first scene of each act, the Bühnenarbeiter would pull them out manually, in full view of the audience.

The lighting for the production was more akin to lighting dance, and somewhat backwards from traditional theatre lighting. There was no scenery to sculpt with light; in fact, great effort had to be made to keep any ambient light off of the screens in order for the projections to be seen. The area to light was kept relatively shallow in order to limit both direct and indirect light from spilling or bouncing onto the screens. However, even the best of equipment created a gentle ambient spill that could reduce the quality of projected images and had to be moved or eliminated. The only three-dimensional forms to sculpt with light were those of the performers and two benches. The stage was lit with strong side light and high back-light, with virtually no front fill to illuminate the performers faces. Most of the front light came from follow spots directed onto the principle performers. While the edge of illusion concept provided us some leeway in the amount of follow spot spill that hit the projection surfaces, the traditional follow spot positions at the rear of the auditorium created too strong of a washout if used throughout the show. Two Source 4 instruments were fitted with irises and follow spot yokes and placed in box boom positions that allowed the operators to manipulate them safely. This permitted more spotlight focus with less screen washout.



Figure 4

Costume design did not provide us much of an opportunity to reveal the edge of the illusion. We were not interested in the performers giving the impression that they were anyone other than their dramatic character. To have the actors drop out of character and appear to be their real selves would, we believed, create a parody of the opera. The action of *The Magic Flute* strains our twenty-first century credibility enough, and we were not interested in deconstruction. We wanted the production to be light-hearted and fun, and so we concentrated on the idea of "The Eternal Fairytale." What we arrived at were sophisticated re-interpretations and tongue-in-cheek variations on visions of "The Eternal Fairytale" as it has come down to us throughout history—Grimm's Fairy Tales, nineteenth-century Wagnerian Opera, Walt Disney, "Prince Valiant," "Star Wars,"—to name just a few. With all of this as the basis for the design, we began to create the game from the start.



Figure 5



Figure 6

Figure 7



## THE GAME

When the audience entered the theatre they saw a bare stage—curtain up, no masking, and the technicians preparing the computers at their upstage location. As the house lights dimmed, a single projection screen flew in at the curtain line. When the overture began a video of rehearsal and shop activity entitled “The Making of *The Magic Flute*” began to play. The video, elegantly edited in time to Mozart’s music, introduced the audience gently, in the familiar form of video, to the process of preparing the production. On the video the audience saw the actors rehearsing, the set and costumes being constructed, the lighting being cued, and, most importantly, the computer operators rehearsing their sequences with their equipment. This light-hearted introduction to the backstage activity allowed the audience to view the process. It showed them the edge of the illusion.

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The overture of *The Magic Flute* has two distinct movements. At the start of the second movement our six Bühnenarbeiter, dressed in the costumes of Mozart's time, entered and began to set the stage. They directed the flying in of the upstage rear-projection screens, swept the stage, and placed the minimal props. They would be onstage whenever necessary throughout the production to accomplish all scene shifting.

When the stage left upstage rear-projection screen was in position, the dragon, "Wolfi"—a CGI character—appeared. The dragon appeared to walk downstage, examined what the Bühnenarbeiter were doing, spit fire at them, observed the second projection screen flying in, walked over to it (momentarily disappearing as he walked from one screen to the other) and inspected the stage right area. As the overture came to an end the dragon walked off the projection screen into the stage left wing and then reappeared on another mobile projection screen carried on from stage left by two Bühnenarbeiter. The first scene of *The Magic Flute*—Tamino being chased by the dragon (and the Bühnenarbeiter with the screen)—had begun. The dragon pursued Tamino into the stage left wing, back across the stage, into the stage right wing, then back onstage, finally trapping him stage center. As the dragon moved downstage to kill Tamino, the Three Ladies enter and stabbed the screen with their swords. The dragon exploded, and the Bühnenarbeiter ran off left with the screen. The game was underway (figs. 1 and 2).

In every scene we sought a clear and direct way to reinforce the edge of the illusion. During Papageno's first scene a forest with a flock of birds flying through it was projected onto the upstage screens. In addition, a Bühnenarbeiter held a small mobile circular screen onto which was front projected an image of a rather goofy bird (fig. 3). As Papageno attempted to catch the bird on the circular screen, the Bühnenarbeiter moved the screen out of his reach. Tiring of pursuing the bird, Papageno sang of his desire to catch a maiden and Papagena's live video image was rear projected as a superimposition onto the upstage screens. The audience could see her image and also the feet of the actress underneath the upstage screens as she stood on her spike mark.

The Queen of the Night made her entrance on a mobile staircase pushed by four Bühnenarbeiter as a special circular screen flew in behind her. Onto this screen was projected a rotating sphere with sparks flying out of it. The same image was projected from the front onto her costume (fig. 4).

As Tamino sang his aria about his love for Pamina's picture, Pamina's live video image was projected inside a picture frame onto the upstage screens while her feet were also visible (fig. 5).

The Three Spirits appeared on a platform pushed on by

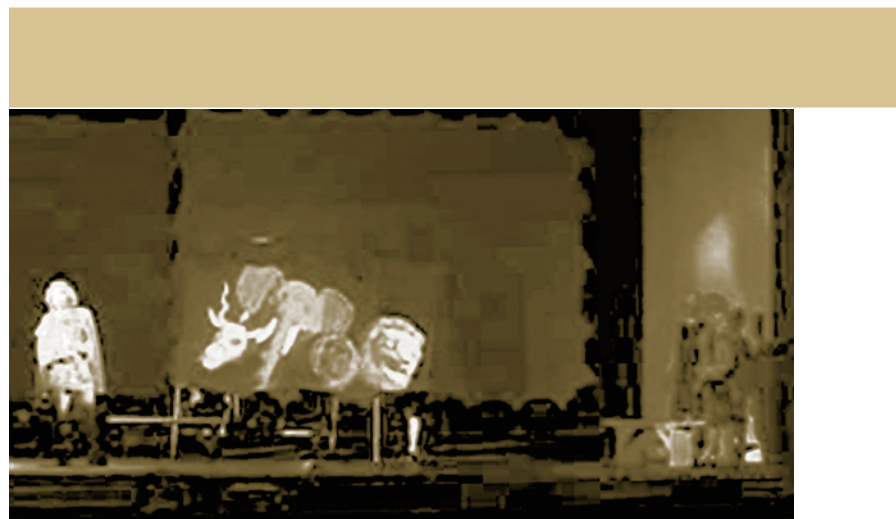


Figure 8



Figure 9

Bühnenarbeiter while a front projection played onto the screen hanging from the front of the platform. The image from the front projector changed with every entrance of the Three Spirits (fig. 6).

Tamino's encounter with the Sprecher took the form of yet another Bühnenarbeiter manipulated mobile projection





Figure 10



Figure 11



Figure 12

screen with a hole at head level. Only the Sprecher's face was visible through the hole and simultaneous rear projection on the upstage screens and front projection on the mobile screen swept us into a tunnel that contained icons of the sum of human knowledge (fig. 7).

When Tamino played the magic flute for the first time and the animals came out to hear him, Bühnenarbeiter brought on another mobile screen onto which was front projected the heads of the dancing animals (fig. 8).

In Act II additional variations to the above were added. Simple shadow projections were used on all the screens for the encounter between Tamino, Papageno and the three Ladies during the trial of darkness. This shadow play, both from the front and from behind throughout the production allowed highly saturated colored light to create larger than life silhouettes (fig. 9). We chose to do this shadow play deliberately, almost as a joke. Here we were creating fantastic technological effects and suddenly we created the simplest effect—a spotlight casting a shadow onto a surface. How simple! Everyone in the audience has done this. Childhood—a flashlight under a sheet—Shadows! Magic! Illusion! We know how this illusion is created. We all know where the edge of it is.

Pamina's aria "Ach Ich Fuhl's" was backed up by a projection generated from a computer program that translated her singing from a body microphone into colorful, real time, abstractions that flowed across the screen in reaction to her voice. Variations in her pitch and volume created abstract vi-

## The revelation of the edge of the illusion was simultaneously obvious and invisible.

sual splashes of color and movement (fig. 10).

During Monostatos's near rape of Pamina, the creepy, bug-like projection on the upstage screens was also projected on him from the front unit, which could serve as a followspot from the orchestra pit (fig. 11).

Papageno's "suicide" took the form of a noose hanging from a very small tree that held three small projection screens and was manipulated by a Bühnenarbeiter. On these screens the goofy birds returned to look down incredulously on the scene (fig. 12).

The fantastic nature of the opera also guided us to create a few images through lighting on the projection screens in lieu of VR projections. By using a Film FX effects strip, Tamino and Pamina traveled through the trial of fire in a highly theatrical manner. As they crossed through the trial of water we added two Studio Spots and a few gobo rotators.

## CONCLUSION

*The Magic Flute* represents the latest in a series of experimental productions focused on the use of real-time computer graphics in live theatre production. In each experiment we have striven to break new ground both in the technologies employed and in the metaphorical content that can be brought to bear with their use.

Many of these developments are relatively invisible to the audience, such as advancements in software or new algorithms for the creation of the virtual elements while others are blatantly obvious to anyone in our audiences. The most apparent innovations found in *Flute* were the use of the doubly wide projection screen at the rear which enabled us to more completely surround the action of the piece within the virtual environments, and the series of smaller, more portable projection screens which in turn made it possible for virtual creatures to enter the dramatic space of the singers.

The revelation of the edge of the illusion was simultaneously obvious and invisible. While the methods of staging described above were plainly visible for all to see, each seemed to be fundamental to our use of the technology and therefore didn't call attention to itself.

We were very pleased with the results of each of these experiments. More than in any of our previous VR productions, the action appeared to be contained within a dynamic virtual environment. Virtual characters or VR enhanced characters appeared onstage in the same space and on equal footing with

live actors and played a significant role in the storytelling. And finally, by revealing the edge of our virtual reality illusion the audience was made part of its creation.

These experiments lead directly to a path for future study. Given an appropriate script, a future production may incorporate computer operators on-stage as characters in the action. The use of the mobile projection screens was also so compelling that we may look to their use in a production of a new dance piece. As usual, with every question answered, several new challenges appear.

**Mark Reaney** explores the use of virtual reality technology as a tool for designing stage sets. He is associate professor in the theatre department at University of Kansas and director of the Institute for the Exploration of Virtual Reality ([www.ku.edu/~ievvr](http://www.ku.edu/~ievvr)).

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