

1863. London. Wintertime. A young man is heading to the theater. He can't get there fast enough because there is a lot of excitement around this new play. It's called The Haunted Man. It's based on a story by Charles Dickens. In fact, Dickens himself might be in the audience tonight.

The man gets to the theater, takes his seat. On stage, he sees another young man, an actor playing a student, working late at night at his desk. Suddenly, a ghost appears on stage. This isn't an actor walking on announcing he's a ghost like Hamlet's father. This looks like a ghost. I mean you can see right through him! The audience gasps. And the ghost is gone.

2023. London. Summertime. A man in his 60s is heading to a concert. He's excited. There's a lot of buzz around this new show. When he finally gets to the arena, the lights go down, and the group ABBA appears on stage. They look exactly like he remembered when he was a teenager. In fact, they literally look like they did in the 1970s because they're not really there. They're holograms.

These two performances are taking place 160 years apart. But they are deeply connected. In fact, they are the same thing. This magic trick from the age of Queen Victoria is now the hottest thing in live entertainment and theme park design. How did that happen?

You're listening to Imaginary Worlds, a show about how we create them and why we suspend our disbelief. I'm Eric Molinsky. And today we are looking at the wild ride of Pepper's Ghost.

So first of all, Pepper's Ghost is not a ghost. It's not even supposed to be the ghost of a man named Pepper – although there is a guy named Pepper in this story, but we'll get to him later. Pepper's Ghost is the term that theater technicians use to describe this particular type of magic trick.

Jim Steinmeyer has worked with magicians like Doug Henning and David Copperfield. He's created illusions for stage productions of Beauty and the Beast, Mary Poppins, and Aladdin. He also wrote a book about Pepper's Ghost.

He says long before it was a stage trick, Pepper's Ghost was a natural phenomenon. It still is. I mean, you've probably seen it yourself.

JIM: When you are in a, a room at night and you're, you've got a candle or a lamp in front of you and you look through a darkened window to the outdoors, you see both the

outdoors and you see your own reflection. And I think everyone can imagine exactly what that is. And that is Pepper's Ghost. The person you are seeing outside that window that looks like you is Pepper's Ghost.

Magicians have been using a trick like this for centuries to make it seem like something was on stage. But the trick got a major upgrade in the mid 19th century. That timing makes sense to Jim.

JIM: You know, there wasn't media at that time. I mean, there were, there were newspapers and books, and then entertainment was something you saw on stage. And so there was a taste for novelty entertainments. That was everything from, from music hall to, uh, you know, strange performances, special effects, lots of special effects on stage. And there was a taste for that sort of thing.

For example, there were several plays with the now-classic scenario where a woman is tied to a railroad track and has to be saved in the nick of time. And this is decades before that became a cliché in silent films.

Jim says they did this by creating a loud rumbling sound and adding a train whistle. The train itself would be made of wood and canvas. And it would be operated by stagehands who would run across the stage with this train and a very bright headlight.

JIM: When you went and saw the production After Dark, which was one of those, uh, theatrical productions where the train appeared on stage, you would see on the poster, it would say The Locomotive Effect will be presented tonight. And similarly, you know, sensational effects were put on stage, and they were, they were highly valued, and entire shows were built around them. I'm sure we can find analogies for that today.

I can't even imagine <laugh>

JIM: That's right. It doesn't happen anymore.

Enter stage left: Henry Dircks. He was an inventor and a civil engineer. He came up with this idea of creating a theatrical ghost. The way he imagined it, an actor would play the ghost off stage. You would shine a really bright light on them. If you put a sheet of glass on stage, and angle it in the right direction, the glass would pick up the reflection of the actor.

But he did not want to fool people. He hated spiritualists who used parlor tricks to conjure ghosts. So he wanted to outdo them and create the most convincing

ghost ever – only to prove to people that these ghost whispers were frauds. Dircks had a good mind for engineering. Show business? Not so much.

JIM: Dircks had a really, really hopeful and stubborn view that he would have a purpose-built theater done for it, um, that would only operate in the daytime because it, it depended on the sun and depended on sunlight to illuminate the figures. So he was, he was trying to develop a theater that was of a special shape where everybody was kind of sitting in a, a raised gallery looking down on the scene. And he was half right, he was half right. The idea of seeing a ghost on stage was really attractive, especially to the Victorians at that time, and especially in this kind of society where they were mad for special effects, but no one actually wanted to build a theater to do this.

Enter stage right: a man called Pepper. Unfortunately, he was not a Sargent Pepper or a Doctor Pepper. They did call him Professor Pepper, although that was a stage name he gave himself.

John Henry Pepper was a scientist and an inventor. He was also the director of The Royal Polytechnic Institution where he entertained audiences with scientific demonstrations. He was kind of like the 19th century version of Bill Nye The Science Guy.

At the time, Dircks was going around town. He was showing people a scale model of the theater he wanted to create for this ghost illusion. Nobody was interested until he met Pepper. Pepper was intrigued. But he thought it needed a little work. So, they redesigned the trick together to make it more convincing and cost effective. h

JIM: And so, what Pepper did instead is he took his lecture hall, and he arranged it so that, so that the glass was tipped forward so that it would reach down and basically get the image of the ghost that was in front of the stage and in effect, visually lift it up and put it on stage. So, Pepper ended up putting the ghost in basically what we would say today is the orchestra pit. He draped it all in black so that the, the orchestra pit itself didn't create reflections. And then he put the ghost dressed in white inside of that pit and illuminated him very, very brightly. And the ghost casts a reflection on the glass, and at the same time allowed you to see the actors who were on stage. The actors couldn't see the ghost. The actors had to do it all by rehearsal and by trust, it would be completely imaginary to the actors, but they would rehearse the scene and would, and assemble it in their minds so that you saw the ghost and you saw the actors at the same time.

They filed a patent together. But Pepper asked Dircks to sign away any future profits from this magic trick. Which he did. As I said before, Dircks had a mind for engineering. But show business? Not so much.

Pepper began using the ghost in a play called A Strange Story. The theater was small. But he made sure it was full of newspapermen.

Then he got permission from Charles Dickens to stage an adaptation of one of his books called The Haunted Man and the Ghost's Bargain. The play was called The Haunted Man for short.

JIM: So, the Haunted Man was really a very short little scene. It was probably no longer than 10 minutes of a student studying at night. And, and a ghost kept appearing in the room and tormenting him and then disappearing. Dickens was a good choice because Dickens, of course, was still alive at that time. And Dickens was a huge fan of magic. He actually performed as an amateur magician. So, there's very little doubt that Dickens had seen Pepper's Ghost on a number of occasions and would've been a fan of all of that.

The Haunted Man was a huge hit. The Prince of Wales went to see it and raved about it afterward.

JIM: Because it was amazing and did get special notice, you know, it brought lines and lines of people to The Polytechnic. Pepper writes about how he had many, many letters from people, ma a number of those were people asking if they were real ghosts.

That is not what Dircks wanted. He wanted to debunk spiritualists. When Pepper brought the trick to larger theaters, he watched his frenemy reap financial rewards and fame. Dircks wrote angry letters to every theater who advertised it as Pepper's Ghost. Didn't they know that he originally had his own term for it? It was supposed to be called Dircksian Phantasmagoria. Why wasn't that catching on?

Now Pepper didn't claim that he invented it. He always gave Dircks credit, even if he took all the money. And Jim says Dircks was a bit delusional in thinking he could've pulled this off without Pepper.

JIM: Pepper made really novel improvements in it, which allowed it to be put into a theater in, in a much more practical way. And he also was able to improve the situation with the lighting. I mean, there were a number of things about Dirk's invention that that would've doomed it.

But it had limitations. In fact, it was kind of a one-trick pony.

JIM: Because the entire scene was seen behind a piece of glass, you couldn't hear the actors on stage. So, all those shows were done in pantomime. Of course, that wouldn't let you put Pepper's Ghost on stage for Shakespeare.

Dircks died in 1873. Pepper lived until 1900. By that point, other magicians were doing the trick in smaller theaters, but they often couldn't do it properly.

JIM: You know, the glass is dirty. The glass is cracked. So, the curtain opens on it and, uh, everybody sees that there's a piece of glass on stage.

By the mid 20th century, the trick had ended up in the most lowbrow of places -- a carnival sideshow called Girl to Gorilla. You'd go into a darkened booth to see an image of a woman. And then she'd fade into the image of a gorilla. This magic trick which at one point had entertained The Prince of Wales had become both creepy, and old fashioned.

Luckily, in the 1960s, the Imagineers at Disneyland were thinking about creepy, and old fashioned things when they designed The Haunted Mansion.

Now I did a whole episode about The Haunted Mansion in 2017. That episode was about the creative battles behind the scenes while they were developing the ride.

But putting that in the context of Pepper's Ghost, what's interesting to me is that the technology of the 1960s solved many of the problems that Dircks and Pepper had in the 1860s.

Think about the moment when you're on The Haunted Mansion ride -- which I hope you've been on at some point in your life -- and your Doom Buggy twists and turns towards the ballroom of dancing ghosts. The seats are perfectly positioned so you don't notice the glass. They have full control of the lighting. All the sounds you need are pumped through speakers. And the ghosts are animatronic so they can perform like clockwork.

And The Haunted Mansion ride never stopped being popular. For many people, that was the first time they saw Pepper's Ghost in action. And some of the kids on the ride grew up to design their own high tech versions of this trick. After the break, Pepper's Ghost becomes a breakout hit all over again.

BREAK

Ben Schrader represents the next generation of live entertainment designers who are using Pepper's Ghost. He's created live special effects for Disney and other companies. His love of Pepper's Ghost goes back to his childhood. I'm not talking about The Haunted Mansion ride, although he did go on it as a kid. From a very early age, Ben had the mind of a magician.

BEN: I had a Luke Skywalker return of the Jedi action figure, and I had an Obi Wan Kenobi Return of The Jedi action figure, the old Alec Guinness figure. And I remember being on the carpet and having them talk to each other. And I remember on our, on our living room shelf, we had empty picture frames. My mom had empty picture frames in case, you know, she spontaneously wanted to, to put one of our school photos in there. I grabbed the glass out of the picture frame, and I can't remember what motivated me, but I just remember grabbing the glass out of the photo, uh, frame, bringing it upstairs to my room with a flashlight. And if I set up the pane of glass just correctly with Luke Skywalker standing at one angle, the pane of glass in between and Obi Wan Kenobi over to the side and flashing a light on Obi Wan Kenobi, I could create a spectral image of Obi Wan Kenobi standing next to Luke Skywalker. And this took my action figure playing to a whole new level as far as I was concerned. I mean, my, my eight-year-old mind was just melted at that moment. And, uh, I thought I invented that <laugh>. I thought that was mine.

He did find another way to take ownership of Pepper's Ghost. He has a Pepper's Ghost tattoo on his arm. It's an old diagram of how the trick works.

BEN: it perfectly sums up my love of magic, my love of science, my love of theater in the arts. It's, for me, it's kind of left brain and right brain working together in harmony to create something breathtaking. That's what I tell myself to justify the fact that I have a Pepper's Ghost tattoo on my arm. <laughs>

All right. I got to see it though now, if it's on your arm, can I just see it <laugh>?

BEN: Yeah, it's here. It's here.

Oh, wow.

BEN: But it's here, so, you know.

Yeah. Look at that.

BEN: It's the eyeball.

Yeah.

BEN: And the perspective of the angle, the angle of the, the audience, the, uh, actor on stage. And then here, this is the reflection, the light source and the reflection, and all

these different angles that make it work. But you know, these angles are great, but what it's not taking into account is what are the angles from the sides?

Well, that's for the other arm.

BEN: Exactly. I need to do the, I need to do the other perspective on this.

As a kid, there was another place where he experienced Pepper's Ghost without realizing it: video arcades.

When video games were in these full sized cabinets that you had to play while standing up, a lot of early games like Space Invaders used Pepper's Ghost to project the game onto a tilted screen. Even the modern teleprompter is a version of Pepper's Ghost.

And in his professional work today, when Ben uses Pepper's Ghost, he has to deal with the same problem that Pepper dealt with. How do you hide the glass in plain sight, so the audience doesn't notice it's on stage?

BEN: And that's tough. I mean, if you're going to reflect one thing, you're going to reflect everything. So, there could be re residual reflection. So, it's not just the glass and the light itself, it's everything around it. Making sure that you get rid of all the pollution of light around it to create that image. So, you know, while I may say that, that the foundation of it is simple, the execution of it, not so much.

A lot of entertainment companies are trying to create more efficient versions of the trick. The Haunted Mansion was able to make it work because they had a lot of physical space in that ride, which the audience doesn't perceive. But live entertainment today needs to be more mobile and flexible.

BEN: In my experience working for Disney, you know, these are multi-use spaces. These are spaces that exist as a, a theater to put on one show one night, and then another entertainment maybe later on in the day or, or, or definitely the next day. So, to set up a true old school Pepper's Ghost illusion can become kind of challenging on stage.

So, a lot of companies have tried to patent their own versions of the trick. They might design their own special glass which is very thin or curved. They've added mirrors to give the illusion more control. And they can now use computer graphics.

BEN: Now we can reflect digital imagery, high quality digital imagery of an image isolated in a black background, and then reflect that on a high quality glass. So, the materials also are getting better, but the foundation of it is the same.

Universal Studios has their own version of Pepper's Ghost at the Wizarding World theme parks. Do you remember in the first book when Harry goes to King's Cross Station, and he has to rush through a brick wall to get to Platform 9 and $\frac{3}{4}$? At the theme park, they created a Pepper's Ghost illusion of that wall.

But the illusion is actually for the people waiting in line. The line curves around and while you're waiting, it looks like the people ahead of you are magically going through the wall. And when it's finally your turn, you can see how it's done and you can even ham it up for the people behind you.

Disney has using Pepper's Ghost more than ever. It's in one of the new Star Wars rides, where the character of Rey appears as a holographic message. It's in the Pinocchio ride where the Blue Fairy appears. And it's in the Winnie the Pooh ride.

BEN: On the Winnie the Pooh ride over by formerly Splash Mountain, uh, watching Winnie the Pooh fall asleep, and an image, a reflected image on glass of Winnie the Pooh going into his dreamlike state to dream about Heffalumps and Woozles, and, and they rotate a model of Winnie the Pooh out of a, a copy of its model on the ride. So, we see a spectral Winnie the Pooh floating away, same with Monsters Inc ride does the same thing. A character that can operate and appear somewhere and then disappear.

Ben used it in a show he designed about Doctor Strange for the Disney Cruise Line. If you've seen the Marvel movies, you know that Doctor Strange has a signature move where he swipes his hand in a circular direction to open a portal. Ben wanted to do that on stage. And this particular show is about Doctor Strange creating an academy for young sorcerers.

BEN: And the entrance of all these students that we introduce these new characters on stage is through a portal, and the entire back of the stage, the set of this, with a couple set pieces in front, is a giant high definition LED screen that has doors built into it and the doors have LED screens and the seams of these doors are very thin. So, with that kind of capability, we can transport the audience into any world and create any set and move that set in any way we want. And in theory, it worked. In theory, we had it in our mind that this was going to work, but we weren't sure until we just saw it and did it.

As Pepper's Ghost is being integrated more into live entertainment shows and theme park rides, it's becoming more of a background effect. And our expectations are so high. I mean we have seen special effects that people in the 19th century could only dream of. But Ben thinks that Pepper's Ghost still taps into something deeply fundamental for us as human beings.

BEN: I mean, if you just wanted to apply it to ghosts, I mean ghosts, that, that's the most romantic thing you can create. The most thrilling thing I think you could potentially try to create on stage or in a ride is, is a ghost. We all want to see a ghost. We all have an, uh, deep, uh, desire or fear, which is in, in my mind, translates to a deep desire. I think any content that calls for asks for a ghost, I always kind of look at and go, well, they're going to make one. I want to see one. That's primal. That's in us, all of our, our folklore, our stories, our desire. You know whether it's, it's, uh, affirmation of the great beyond, or it's a warning to danger. You know? It's, it's those inherent deep things that the ghost aspect of it, I think is the most fascinating. And so any, anything we can do to try to make that real for us, that's what Pepper's Ghost is. It's trying to make that real.

And these days, we are seeing a lot of digital ghosts on stage.

It started in 2012 with the hologram of Tupac Shakur at Coachella. Since then, there have been holograms of Roy Orbison, Buddy Holly, Frank Zappa, Whitney Houston, Michael Jackson, and Maria Callas.

They have all entertaining live audiences – even if the word “live” doesn't apply to everybody in the room. I asked Jim Steinmeyer if these holograms are basically Pepper's Ghost.

JIM: Is it basically Pepper's Ghost? It is Pepper's Ghost. One of the, one of the great ironies of this is the word hologram. Those are flat images. Those are two dimensional images. It's, it's like a transparent movie screen on stage. And I think that's amazing. That's the amazing thing that happens when you really see it and you see the old one, like you see it in Disneyland because those ghosts are completely three-dimensional. Those ghosts are real, and they have depth, and they have volume. You're seeing it from a changing point of view. And they're always correct. They never go flat.

That's fascinating to even think about that. That's true. So, I guess Disneyland, those are either maquettes or, or that are moving or animatronics, um, that are being projected as opposed to beforehand it was real people and then now it's just flat, you know, filmic images.

JIM: In a very weird way, the original Pepper's Ghost where there were three dimensional people playing the ghosts was probably the most amazing of all of them

because they were real people. They moved like real people, and they were completely dimensional. And people in a theater would've appreciated that. And so, I think what we'd find is that, you know, if we find ourselves right back in the middle of the Victorian age, we would see probably the most amazing examples of Pepper's Ghost even as we evaluated in a modern way.

Hmm, that's interesting, even just the image of, you were saying how when you look into a window and you see yourself and then you see, um, what's outside. If I wanted to make a very cheesy conclusion, I could say, aren't we all Pepper's Ghost in one way or another?

JIM: Well, you know what's interesting, what's not insignificant about that is that, um, you know, yes, we all have the potential of been Pepper's Ghost, but I think what's even more important than that is, is that we've all learned to ignore that. We've all learned to look out that window, see ourselves. And, and what I would say is just look through ourselves and ignore it. We, we look at the scene that we want to see outside and if anything, we're slightly annoyed by the bright reflections of ourselves because it ruins the image and we just look past it. No one looks outside and says, oh my gosh, there's an amazing transparent ghost of me standing outside. You know, that's really indicative of what a magician does, is that there is no secret in magic that's really precious or completely unique, or even to some extent worth hoarding because they're all very simple scientific principles. But again, they're being used to tell stories. They're being used to give fantasies, and the audience is along for that ride. The audience who is anxious to put that fantasy together in their heads will look at something that they really are familiar with, but because they're looking at it in a different setting, it becomes something amazing to them. And I think Pepper's Ghost is a really brilliant example of that. You know, we've all seen it, we've all been Pepper's Ghost, but in the right setting, telling us about a ghost giving us this amazing fantasy, we're ready to look at it in a different way. And that's what Dircks knew, and that's what Pepper knew. That's what all those old showmen knew, and we were able to put in front of their audiences.

There's a quote by Arthur C. Clarke which has actually been paraphrased over the years into a much more concise expression: "Magic is just science we don't understand yet."

It can also be science that we don't want to understand, at least not yet, because we want to believe in magic for a little bit longer.

That's it for this week, thank you for listening. Special thanks to Jim Steinmeyer and Ben Schrader.

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