

Victorian Theatrics

Nineteenth-century entertainment was a peculiar mix of technological innovation and supernatural thinking

On December 24, 1862, a new theatrical adaptation of Charles Dickens's fifth and last Christmas novella—his first being *A Christmas Carol*—premiered at the Royal Polytechnic Institution in London. In *The Haunted Man and the Ghost's Bargain*, an aging, gloomy, Scrooge-like chemistry teacher called Redlaw asks to have his memory erased. A ghostly doppelgänger grants him his wish but also curses anybody with whom he interacts to suffer the same fate.

Theatergoers attending this particular performance were in for a shock: instead of confronting the usual flesh-and-bone actor with a sheet over his head, Redlaw faced an incorporeal entity that materialized onstage, apparently out of thin air. Spectators were astonished.

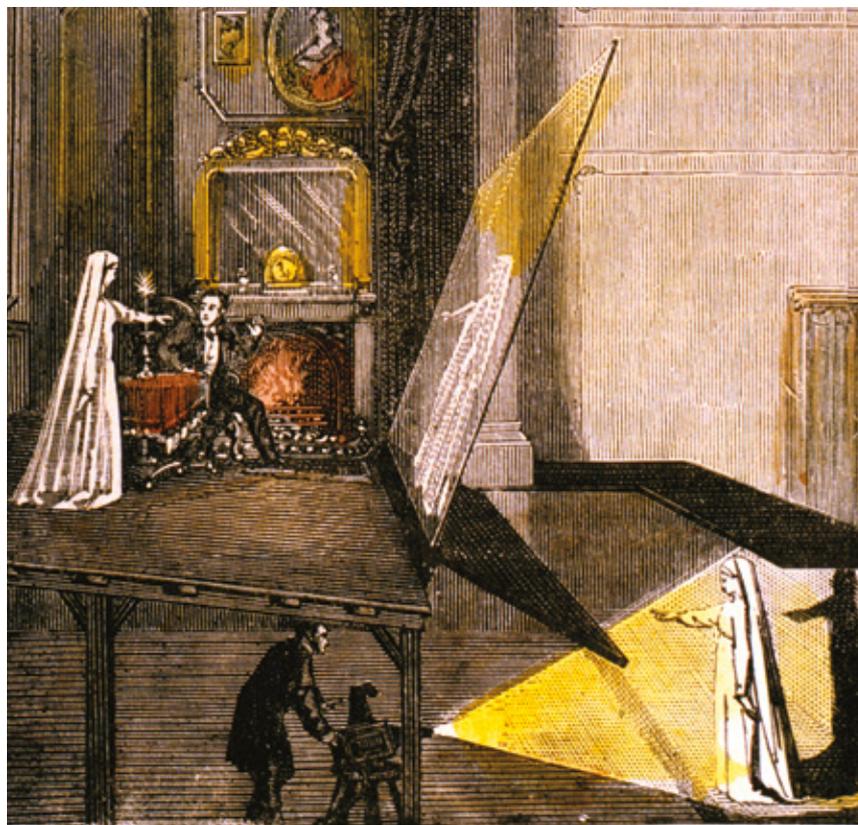


BY SUSANA MARTINEZ-CONDE AND STEPHEN L. MACKNIK

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The artist behind this illustration, published in the 1880s, took a few liberties. In reality, the actor below the stage must lie against a black inclined background to cast no shadow and correctly reflect on the glass. In addition, the pane is not a projection surface. The audience perceives the ghost as behind, not on, the glass—roughly where the apparition stands on the stage.

The play, which had not been performed in London for more than a decade, became an instant sensation. Enthralled audiences filled the Royal Polytechnic's 500-seat theater for 15 months straight, shelling out £12,000—or the equivalent of more than \$2 million today.

The otherworldly apparition was a stage illusion that came to be known as Pepper's Ghost, the brainchild of Liverpool civil engineer Henry Dircks and Professor John Henry Pepper, a prominent London chemist and science popularizer. Dircks and Pepper's joint patent gave all the financial rights to the professor, and the two inventors fell out shortly after its issue over matters of credit and precedence.

But versions of their Ghost continue to delight audiences to this day. Look for Pepper's Ghost in Alfred Hitchcock's *The*

39 Steps or the James Bond flick *Diamonds Are Forever*. The same illusion was put to work in Disneyland's Haunted Mansion, where riders see specters materialize before them. These projections appear strikingly three-dimensional, in part because they retain many of the cues that inform our visual perception of depth in everyday life, such as size, shading and texture. And unlike a standard projection experience, such as what we see at a movie theater, there is no visible screen to tip us off that we are viewing a two-dimensional image on a flat surface. Instead the Pepper's Ghost illusion employs transparent surfaces so the image appears to be cast in thin air. (For more details, see "It's All Done with Mirrors," on page 20.)

A growing understanding of the visual sciences in Victorian times not only

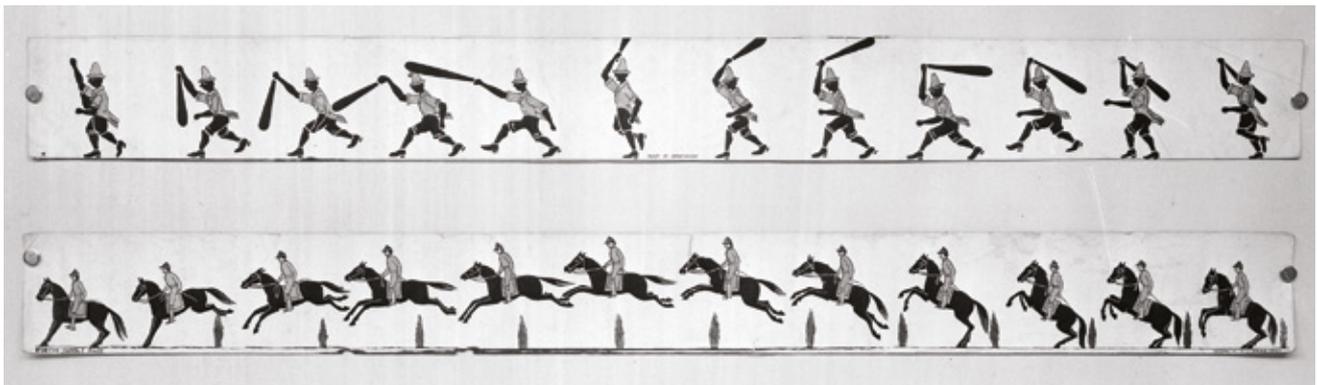
enhanced entertainment in the theater but also launched the development of early cinema. Contemporary filmmaking techniques, as well as their earliest predecessors, rely on a perceptual process discovered by Peter Mark Roget, best known for his famous *Thesaurus of*

English Words and Phrases. In an 1824 presentation to the Royal Society of London, Roget revealed the “persistence of vision”: the retina’s ability to retain an image for $\frac{1}{20}$ to $\frac{1}{5}$ of a second after its disappearance. This phenomenon allows us to bridge the temporal gap between

two consecutive static images of a moving object—think of two movie frames—and see continuous motion instead.

This article showcases the use of novel scientific and technical understanding to create unprecedented spectacles and theatrical illusions in Victorian society. **M**

BEFORE THE MOVIES



From 1833 to 1834, British mathematician William George Horner developed the zoetrope, a cylindrical device that sweeps images across the visual field as it turns, producing animation. One critical aspect of the zoetrope is that the images are periodically blocked, so that objects in them do not

appear to continuously slide in and out of the scene. To further hide the sweeping of the objects, viewers may peer through a narrow slit. Modern movie projectors are a type of zoetrope, in which a flickering light turns off while the film advances to the next frame and then turns back on—projecting the

image to the screen—only when each new frame is stationary and aligned with the previous one. Zoetrope technology led to modern television and computer-animation systems that update the image periodically without physically sweeping each separate image on and off the screen.

GHOSTBUSTERS!

The success of Pepper’s Ghost with Victorian audiences underscores their double fascination with science and the supernatural. The 19th century was a time of extraordinary scientific and technical achievement—think of the telegraph, telephone, pasteurization and Charles Darwin’s *On the Origin of Species* (1859). This fresh interest in science clashed with traditional religious beliefs but counterintuitively opened the door to a new kind of magical thinking: the Spiritualist movement, which held that people could communicate with the dead.

Spiritualism drew strength in part from recent scientific—and pseudoscientific—efforts. Animal magnetism (also known as mesmerism, after its founder Franz Mesmer) used techniques similar to those in modern hypnosis to allegedly reveal an individual’s deepest thoughts. Sigmund Freud, the creator of psychoanalysis, took these claims as evidence of the subconscious. And some Spiritualists co-opted this idea of a subconscious, claiming that it was from this space that ghosts and spirits manifested.

Psychic and parapsychological research afforded spiritualism extra credibility. Séance mediums proliferated, offering customers the “tangible” supernatural evidence that churchgoing did not provide. In practice, of course, these séances were little more than elaborate performances, as Victorian magician John Nevil Maskelyne—inventor of the pay toilet—and Ehrich Weiss (aka Harry Houdini) revealed in a series of exposés. They kicked off the ongoing tradition among magicians to debunk such “paranormal occurrences.”

Alongside séances, spirit photography, which claimed to capture ectoplasmic pictures of ghosts, also became popular. In reality, photographers manipulated the images after the fact, using ink or double exposure, among other techniques (the 19th-century equivalent of digitally altering pictures using Photoshop).



IT'S ALL DONE WITH MIRRORS



Plain glass can be reflective or transparent, depending on how strong the light is on either side. And in certain lighting conditions, it can be both. This is the secret behind Pepper's Ghost.

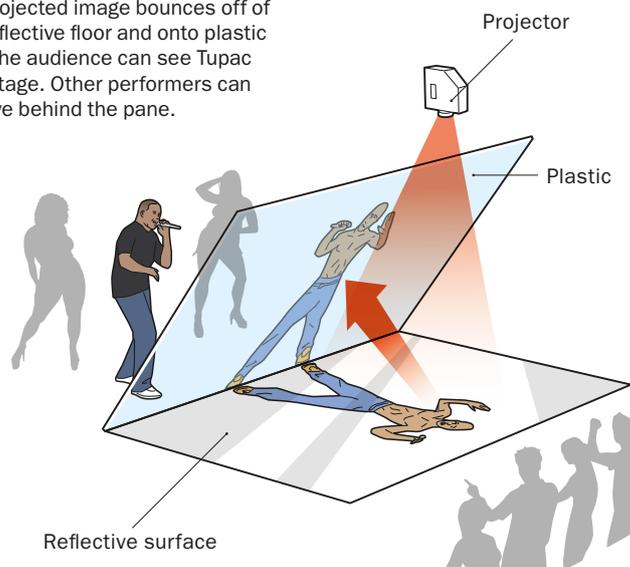
In 2012 a ghostly semblance of murdered rapper Tupac Shakur performed alongside fellow artists Snoop Dogg and Dr. Dre at the Coachella Valley Music and Arts Festival in California (above). What many spectators and reporters took to be a 3-D hologram of the rapper was in fact a 2-D image based on technology from the 19th century. Specifically, Tupac's projected image bounced off a reflective floor onto a plastic surface angled at 45 degrees—a design (at right) that recaptured the essence of Dircks and Pepper's innovative blueprint.

In the original 1862 arrangement at the Royal Polytechnic, the audience sat at the same level as the actors onstage, while the performer playing the ghost hid in the orchestra pit below. A large piece of glass was angled so that it could reflect a view of the pit toward the audience. When the lights were bright on the main

Tupac: Not Live but in Concert

A 20th-century spin on a classic Victorian special effect

A projected image bounces off of a reflective floor and onto plastic so the audience can see Tupac onstage. Other performers can move behind the pane.



stage and dark below, the reflection of the ghost stayed hidden. But when the lighting above dimmed and grew bright below, the reflection suddenly appeared. Space limitations under the stage allowed for reclining and sitting ghosts only. Later refinements permitted standing and walking ghosts.

THE BIRTH OF FILM



Photographic and theatrical illusions gave way to the nascent film arts at the close of the 19th century. French magician Georges Méliès, who brought his conjuring background to moviemaking, pioneered cinema as entertainment (above). He also invented and adapted innovative special effects for film, such as the stop trick technique—in which objects and people in a movie scene change while the camera is off—to make actors disappear and reappear as, say, skeletons, among a myriad other illusions.

In 2011 Martin Scorsese's movie *Hugo* paid homage to Méliès's legacy. In one of the scenes, Ben Kingsley, playing Méliès, performs a levitation trick at the Robert-Houdin Theater in Paris (founded by renowned magician Jean-Eugène Robert-Houdin, from whom Houdini took his stage name). Méliès's assistant lies horizontally in midair, not thanks to CGI magic but to Victorian artifice unearthed by present-day illusionist Paul Kieve at Scorsese's request.

MORE TO EXPLORE

- **Explanation of an Optical Deception in the Appearance of the Spokes of a Wheel Seen through Vertical Apertures.** P. M. Roget in *Philosophical Transactions of the Royal Society of London*, Vol. 115, pages 131–140; January 1, 1825.
- **The Science behind the Ghost!** Jim Steinmeyer. Hahne, 1999.
- **Quick and Magical Shaper of Science.** J. A. Secord in *Science*, Vol. 297, pages 1648–1649; September 6, 2002.
- **Spectres of the Self: Thinking about Ghosts and Ghost-Seeing in England, 1750–1920.** Shane McCarristine. Cambridge University Press, 2010.
- **Vision: Temporal Factors.** Stephen L. Macknik and Susana Martinez-Conde in *Encyclopedia of Perception*. Edited by E. Bruce Goldstein. SAGE Publications, 2010.
- **Theatre and Ghosts: Materiality, Performance and Modernity.** Edited by Mary Luckhurst and Emilie Morin. Palgrave Macmillan, 2014.