2   The History of Reality Media

In chapter 1, we traced the history of AR and VR back to the 1960s and Ivan Sutherland's Sword of Damocles, which made its user into an ungainly looking cyborg. We can trace the lineage much further back into the history of media. By placing AR and VR in this historical context, we can appreciate how they address the task that has characterized certain media technologies and forms for centuries. This is the task of capturing visual reality—or rather, of convincing the viewer that this particular medium achieves the goal of capturing visual reality better than any other.

Some writers like to claim that the Paleolithic cave paintings like those at Lascaux in the Dordogne region of France were the earliest instances not only of art but of VR as well—so many writers that it was almost inevitable that the *New York Times* and Samsung would make a VR tour experience for the caves (Rousselle, Shastri, and Mullin 2016). The media scholar Oliver Grau (2003) began his history of VR with Roman painting in Pompeii in the first century AD, where some of the villas' walls were preserved because they were buried in volcanic ash from the eruption of Vesuvius. We will begin our history, however, in the Renaissance because from that time on there has been a continuous tradition of applying techniques of illusion in order to construct visual reality.

Painting as a Reality Medium

It was in Italy in the fifteenth century that architects and painters developed the system of linear perspective in practice and in theory (Edgerton 2009). Their techniques drew from the science of optics that was part of the developing Scientific Revolution. Linear perspective was believed to make

a painting as realistic as possible because it imitated the way rays of light reflected off objects in the world and could be focused on a surface. In other words, linear perspective was supposed to capture the way we "really" see the world.

Around 1425, the Florentine architect Filippo Brunelleschi performed a demonstration to show how linear perspective could make painting into a reality medium. Using the technique of vanishing points, and perhaps with the help of a mirror, he painted the Florence Baptistry on a small wooden panel from the perspective of someone standing at the portal of the cathedral looking toward the Baptistry. He also made a small viewing hole in the panel. He then stood at the place from which the perspective was drawn. In one hand, he held the panel in front of his face with the painting facing away; in the other, he held a small mirror. Looking through that hole, he could see the picture reflected in the mirror. When he took the mirror away, he could see the actual Baptistry. This procedure allowed him to test the painting against the reality of the building itself. By letting others look through the hole and then taking away the mirror, Brunelleschi demonstrated the efficacy of his technique (illustrated in figure 2.1).

The demonstration has sometimes been characterized as a Renaissance version of augmented reality (Levy 2012, 27). It might be better to claim it is the first example of what is called *diminished reality*, in which AR technology is used to overlay and therefore obscure something that the user would
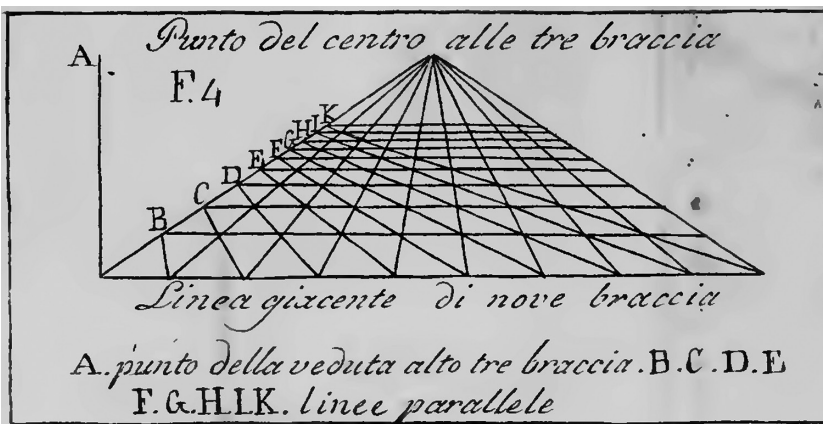

Figure 2.1
Brunelleschi's perspective technique, as documented by Leon Battista Alberti (1804).

otherwise see in the world, such as the Baptistry. In any case, Brunelleschi's configuration of the mirror and painting lacked the quality of computer-based real-time rendering and registration that are characteristic of AR. Brunelleschi had to do the alignment himself, whereas AR today performs the drawing, sensing, and tracking automatically. But the experiment was a perfect example of the La Ciotat technique: the purpose was not to forget or elide the medium of painting, but rather to confirm how well the medium constructed visual reality.

Brunelleschi's technique, based on synthetic geometry, involved drawing lines to one or more vanishing points to create a sense of perspective. Computer graphics makes this same process truly automatic, using linear algebra transformations to calculate how rays of simulated light from 3-D objects would land as points on a plane in front of the user. What the computer does algebraically in its graphical processing unit (GPU) today, Renaissance and later artists achieved geometrically, sometimes by sketching projection lines on paper or canvas. Some later artists, including Dürer and Vermeer, were known to have worked with grids or an imaging device (a *camera obscura*), and Brunelleschi himself may have used a mirror (Edgerton 2009). As Renaissance humanist Leon Battista Alberti (2005) described it in his 1435 treatise *On Painting*, the painter makes his canvas into an "open window" through which the viewer appears to see a scene on the other side. Many, perhaps most, European paintings from the Renaissance until the nineteenth century were done using perspective techniques and other methods to support this illusion, which ironically has also been called *realism* or *realistic painting* because of the conviction that this is how the eye really sees the world. The terms *illusion* and *realism* come to mean the same thing. For centuries, Alberti's window therefore helped to define visual reality for European culture.

But if most paintings in this era aimed at achieving this effect, there was a particular kind of art, called *trompe l'oeil*, that went further. The most impressive trompe l'oeil of the period were frescoes on walls or ceilings of churches or large public rooms, such as the vault of the Sant'Ignazio Church in Rome painted by Andrea Pozzo, which features a fresco that makes it look as if the vault opens to the heavens. If a viewer stands in the right spot, the perspective lines up perfectly, and she cannot tell where the physical architecture ends and the painting begins. Trompe l'oeil locates the viewer in a hybrid space that is part physical and part virtual (figure 2.2).
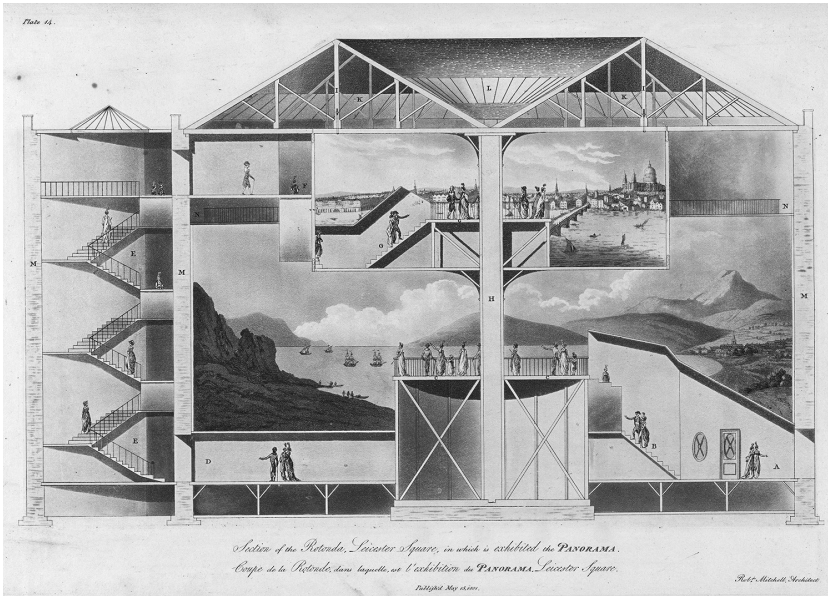
Figure 2.2
Fresco with trompe l'oeil. Andrea Pozzo, Sant'Ignazio Church in Rome. © 2006 by
Marie-Lan Nguyen/Wikimedia Commons. Reprinted with permission.

Baroque trompe l'oeil was, in a sense, a forerunner of AR in that it com-
bined the physical (the architecture of the hall or the church) and the virtual
(the painting). In another sense, it was a forerunner of VR in that it blended
the painting into the whole building to create a seamless 360-degree envi-
ronment. A crucial difference between this Renaissance technology and
contemporary AR or VR is, of course, that trompe l'oeil is a still image,
painted with one vantage point. Wearing a headset, today's user can move
her head or change position, and the computer will adjust the perspective
accordingly. But in Sant'Ignazio, the visitor must stand relatively close to
the favored spot. Stepping out of the magic circle where the perspective
works breaks the illusion, and the visitor is suddenly made aware of the
medium again. In this case, stepping in and out of this perspective circle is
perhaps the best way to appreciate the La Ciotat effect, a pleasant sense of
wonder at the illusion.

The Panorama

At the end of the eighteenth century, an Irishman named Robert Barker
employed perspective painting to create a related form, for which he coined

the name *panorama*. Barker's panoramas were fully immersive trompe l'oeil buildings, virtual environments consisting of a painted canvas stretched all the way around a rotunda. The viewers stood on a platform in the middle and experienced the vast painted scene in whichever direction they looked (except on the ceiling, but the roof of the building was designed to emit diffused daylight to support the illusion). In 1793, Barker built a panoramic theater in London's Leicester Square. For three shillings, Londoners could experience a 360-degree view of their own city as if they were standing at the top of St. Paul's Cathedral, which was in fact only two miles away (figures 2.3 and 2.4).

Figure 2.3
Illustration of Barker's panoramic theater (Mitchell 1801).

Figure 2.4
Robert Barker and Henry Aston Barker, *Panorama of London from the Roof of Albion Mills*, 1792.

Again, it was the La Ciotat effect, the thrill of the technology mediating reality in a new way, that attracted visitors. The thrill would be enjoyed by many thousands of viewers throughout Europe in the nineteenth century, when hundreds of temporary or quasi-permanent panoramas were erected, depicting cityscapes, landscapes, and historically important battles. In *The Panorama: History of a Mass Medium* (1997), Stephan Oettermann described how this popular entertainment phenomenon swept the continent in the century before film. Mass popularity led to many variations and developments, such as moving panoramas and dioramas, although few of these survive today.

The panoramic exhibits were not always purely virtual. In addition to the painted canvas, some exhibits had physical artifacts on the floor. A panorama of a battle might include shrubbery, rocks, and perhaps even wax figures of soldiers leading up to the painting. In Milgram and Kishino's terms, such a panoramic exhibit would be an *augmented virtuality*—closer to the virtual end of the spectrum than the physical.

Photoreality

While the panoramic exhibition is an almost forgotten reality medium of the nineteenth century, two others from that period, photography and film, continue to have a defining place in our media culture. Photography developed through mechanizing the process of linear perspective. Already in the eighteenth century, the camera obscura had been used to focus light on a surface at the back of the box or on to a mirror that reflected the image up for viewing.

The image in a camera obscura was ephemeral until the development of modern chemistry that made another medium possible. The myth of photographic reality, an early version of the La Ciotat myth, was almost immediately born. As Fox Talbot, the British pioneer of photography, put it in the title of his illustrated six-part essay *The Pencil of Nature* (1844–1846), a photograph was an image "impressed by Nature's hand" (i). Despite the fact that the camera and photographic film (like today's digital sensors) were sophisticated technologies, the photograph seemed (and still seems) to have a special claim to authenticity—which is why, for example, it is still recognized as legal evidence.

> **The panoramic exhibition is the forgotten reality medium of the nineteenth century, but two other technologies from that period, photography and film, continue to have a defining place in our media culture today.**

For two hundred years, photography has enjoyed a greater reality status than drawing or painting. This is true even when the photograph has a narrow field of view. Employing photography to make a panorama produced a medium that strengthened its claim to reality by combining the claims of each. One early technique was simply to stitch together a series of narrower photographs (figure 2.5).

Photographers later developed systems using wide-angle, rotating, or multiple lenses to capture more, or all, of a 360-degree view on the flat surface of the film. These systems had colorful names, such as the Stereo Cyclographe, the Wonder Panoramic Camera, and the Periphote, and more recently, the Hasselblad X-Pan or the Linhof Technorama. When the panorama was just a set of conventional photographs stitched together into a long strip, then there was no consistent point of view (POV), a step back from the hand-drawn panoramas of the nineteenth century. The more advanced camera systems that maintain a single viewpoint have to distort the spherical world into a flat image through some sort of optical projection. A common projection used today is an *equirectangular projection* (figure 2.6).

For decades, panoramic photos were generally displayed in a flat format, like any other photograph. The advent of the digital medium offered new opportunities for creating and displaying such panoramas. Digital cameras—some costing less than $200—can record panoramic images more

Figure 2.5
An early flat photographic panorama of Philadelphia in 1913. Haines Photo Co., Copyright Claimant. *Panorama of Philadelphia.* Pennsylvania United States Philadelphia, ca. 1913. Photograph. https://www.loc.gov/item/2007661477/.

Figure 2.6
An equirectangular projection: the image is distorted in the vertical direction moving away from the horizontal centerline. This results in visible bulges. Père Lachaise, Paris. Photo by Maria Engberg.

easily and with fewer flaws than the earlier analog systems, and computers can display them dynamically, providing a full 360-degree experience even on a conventional screen. Viewing such images in a VR headset is even more compelling. And in addition to photographic panoramas, the computer can create and display 3-D graphic panoramas. In the 1990s, video games began to use panoramas called *skyboxes* as backdrops for shooters and role-playing games. As the player moved around and turned, she could see the sky or other backgrounds in all directions. Most players today still experience their games on conventional flat displays, although the increasingly popular VR headsets make greater immersion possible.

Digital panoramas are not limited to video games. Google Street View has already captured much of the developed world in millions of panoramic images (Wikipedia contributors 2020c). When you use Google Street View to visit some other location in the world—somewhere else in your city or somewhere on another continent—you are entering a metaverse (chapter 8). Because the VR experience of Street View is anchored to this world, not to some imaginary other storyworld or game universe, it is like Barker's panorama in Leicester Square, where visitors came to experience virtual views of the very city they were in.

As a reality medium, however, digital panoramas are still Potemkin villages compared to real-time VR. Unlike the modeling of reality through computer graphics, the panorama is a remediation of a photographic (and therefore static) representation of reality. In real-time VR, each object can move and change separately. In a virtual office composed of 3-D graphical objects, for example, you might move a chair from one end of a table to another. But in a panoramic photograph of that office, nothing can change. (So-called *lightfield photographs* are different, but they can only alter the viewer's point of view, not the objects in the photograph.) Almost all the reality media we have reviewed thus far (illusionistic painting, panoramic painting, photography, and even panoramic photography) have been static. The exception was the moving panorama, a long static image that was unrolled in front of the audience to convey a sense of motion. The first fully dynamic reality media date back to the late nineteenth century and flourished in the twentieth.

Film and Television as Reality Media

In the final decades of the nineteenth century, inventors were working on various mechanisms to lend the illusion of motion to sequences of static images, among them the zoetrope, the praxinoscope, and the phenakistoscope. In the 1890s, the Lumière brothers added another to the list, the cinématographe, which is now recognized as one of the first fully successful film cameras and projectors. It is the device that produced, for example, *The Arrival of a Train at La Ciotat Station*, described in the introduction (figure I.1).

The arrival of that train in a small town on the Côte d'Azur announced the arrival of a reality medium that depended on and at the same time enhanced the authenticity of photography. Although the early black-and-white films were overexposed and jerky (recorded at sixteen to twenty frames per second), they succeeded in reproducing a facet of reality that still photography could not. Even when viewed on large screens, however, these films could not surround and immerse the viewer, as Barker's painted panoramas had done a century earlier. Rather than striving for visual immersion, film addressed different aspects of our real-world experience: motion and time. Synchronized sound was added to film in the late 1920s

and early 1930s. Although color film processes existed in the first decades of the twentieth century, most commercial movies were generally shot in black and white until the late 1930s (notable color productions included *The Wizard of Oz* and *Gone with the Wind*), and it wasn't until the 1950s that color became common. With the addition of sound and color, the conventional wisdom was that film technology had reached a certain sense of completion. (We note later in this chapter that Maxim Gorky's two complaints about the Lumière brothers' film were that they were silent and that they were in ghostly black and white.) But innovations and refinements to formats and to sound and color quality have continued.

A conventional photographic or film camera looks at the world through a single lens, but human beings have stereoscopic vision. The photographic stereoscope became popular as early as the 1850s, and already in the 1920s the film industry was experimenting with techniques for stereoscopic movies (Zone 2007). In the 1950s, these experiments resulted in a brief golden age of 3-D (Rogers 2013; Zone 2007, 2012). If you were willing to put on polarized glasses (and millions were), you could watch the scaly Gil-Man menace a beautiful female scientist in *Creature from the Black Lagoon* (1954) or the two lions lunge out of the screen in Arch Oboler's 1952 *Bwana Devil* (figure 2.7).

But the thrill of experiencing this aspect of visual reality captured in film form waxed and waned, and various 3-D or curved-screen formats with yet more colorful names (Cinerama, Space-Vision 3D, and Stereovision) failed to last. Eventually, IMAX in the mid-1980s established a niche and developed into the significant film form that it is today (Rogers 2013). Other forms of 3-D presentation requiring glasses have become almost required for animated films and some kinds of Hollywood blockbusters. These can all now be part of the experience of going to the movie theater.

A film, like a photograph, is always a recording of some past moment. Whether it is fiction or documentary, we know that whatever we see on the screen must have happened in the past. Even a sci-fi story that purports to take place on another planet in a distant future was actually filmed at some moment in our terrestrial past. Film is in this sense a nostalgic medium, always inviting the audience to look back. There has long been a desire for a medium that is truly present, one that would permit distant communication in what we now call *real time*. As the term *real time* suggests, instant
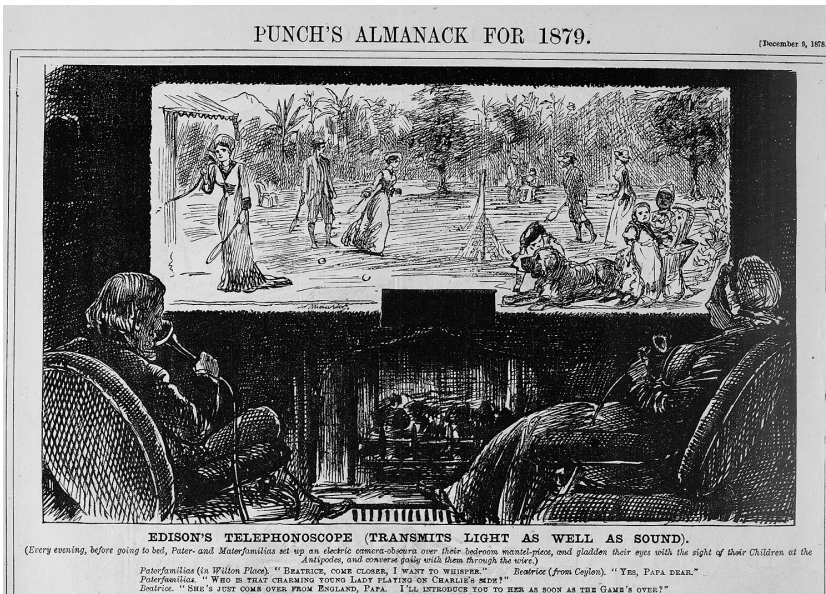
Figure 2.7
Audience members mesmerized by *Bwana Devil* on November 26, 1952, at the Paramount Theater in Hollywood. © J. R. Eyerman/The LIFE Picture Collection via Getty Images. Reprinted with permission.

distance-annihilating communication could make a medium seem more authentic, more real. And there was evidence of the desire for a real-time medium even while film technology was being developed. A well-known illustration in the British magazine *Punch* from 1878 satirically envisioned the invention of the "telephonoscope," which would transmit images as well as sound (figure 2.8).

This illustration and descriptions in science fiction predate the practical realization of television by several decades. When it did come, television was generally a one-way communication device, rather than a two-way videophone. (As it turned out, the videophone would not become viable until the arrival of Internet-based systems like Skype and FaceTime.) Crude and then increasingly refined systems for broadcast television developed in the 1920s and 1930s. The BBC began regular broadcasts in the 1930s to thousands of receivers (Wikipedia contributors 2020e); Germany offered regular broadcasts in Berlin and Hamburg (Wikipedia contributors 2020d). After World War II, in the early 1950s in the United States and somewhat later in Europe, television finally developed into a mass medium with millions

Figure 2.8
The cultural desire for television predated its invention (du Maurier 1878).

of viewers. Television had succeeded in filling the gap that film had left open for a medium that presented moving images and sound "live," more or less as they happened, even if the source of the broadcast was thousands of miles away.

The concept of liveness really only became meaningful after the development of recording technologies (Auslander 2008). Liveness is not the same thing as our lived experience of the world; it is a mediated representation of that experience. Prior to the audio record and film, concerts and plays could not be other than live. Audio recordings and films then made it possible to hear singers or watch actors when the performers were not present. Film remediated plays; audio records remediated concerts; and so liveness was born as the opposite of these new mediated experiences. But just as film and records took away the quality of liveness, television arrived to restore it. Until the late 1950s, most television was broadcast live. As video-recording technology improved, more and more primetime television was recorded, especially comedy and drama. Nevertheless, one defining quality of television was its ability to present events as they happen, and this often remains true of two characteristic television genres: the news and the coverage of sports.

It was liveness that validated television's special claim to being a reality medium. In other respects, television throughout the second half of the twentieth century still fell short of film: television was broadcast on small screens and for years in black and white, whereas the film industry developed color and widescreen formats (such as Cinemascope, Panavision, and VistaVision) in order to offer the public an audiovisual experience that was worth leaving home for. Television, of course, improved in quality too, first adding color and then introducing the VCR and the DVD, both of which further complicated the notion of liveness. The film industry has tried to keep pace. Ever since the middle of the twentieth century, the industry has continued to develop projection techniques and sound systems to offer the audience a more compelling audiovisual experience.

As digital technology began to replace analog in both film and television, these two reality media have converged—or perhaps we should say diverged—in dozens of hybrid formats. Now that almost all television shows and movies are recorded and consumed digitally, we can watch them on a variety of devices, from large LED screens at home to tablets and smartphones. Yet our media culture still refers to these digital videos

as either television series or films (on Netflix, for example), based on their (presumed) original presentation as either broadcast television or in film theaters. There are now born-digital productions, such as video podcasts and YouTube channels, that seem to be both new and remediations of their two-parent reality media.

360-Degree Video

Another digital form has emerged that is in the tradition of the panorama but designed for an individual using a personal device: 360-degree video. Unlike true VR, 360-degree videos (also called VR videos or VR movies) are not generated in real time. Just as traditional movies consist of a set of photographic images shown at a rate of twenty-four or thirty frames per second, a 360-degree video consists of a set of panoramic images, each of which is an equirectangular projection (Johnson 2017; Keene 2018). Each image is displayed for only a fraction of a second and then replaced by the next one. The result is the same illusion of motion that we get when we watch a flat video on a digital screen. With the proper software, 360-degree videos can be viewed on any video screen, but they are best appreciated with a headset. All sorts of 360-degree movies have been created, many in established genres, such as documentaries, music videos, short horror films, and animated shorts, as we discuss in chapter 6.

Just as the painted panorama remediated the perspective painting and the photographic panorama remediated the photograph, 360-degree videos are clearly remediations of film and occupy an intermediate position between traditional flat film viewed on a rectangular screen in a theater and true computer graphic VR. Because they are prerecorded, 360-degree videos lack the capacity for interactivity that VR offers, but they do give the viewer greater control over her point of view. In 360-degree video, the creators lose some of the traditional filmmaking strategies or characteristics of camera angles, continuity, cutting, close-ups, and composition—the five Cs of cinematography originally identified by Joseph Mascelli in a classic work on the subject (Mascelli [1965] 1998). Some of those five Cs are still available in 360-degree films (especially continuity, cutting, and composition), but they are used in different ways than in traditional film. Directors and filmmakers have argued that 360-degree film does away with camera angles because everything is visible all the time. VR filmmaker Gabo Arora has spoken of

the difficulty of learning how to edit away camera equipment and people or to hide them behind objects on the set (Sheffield Doc/Fest 2018). These manipulations, however, show that the placement of the 360-degree camera or cameras still matters, and the process of deciding where that camera will be still belongs to the filmmaker even in 360-degree video.

In the prologue of *The Five C's of Cinematography*, Mascelli ([1965] 1998) suggested a sixth C—cheating—which he defines as the artisan's skill: "Cheating is the art of rearranging people, objects or actions, during filming or editing, so that the screen effect is enhanced. Only experience will teach the cameraman or film editor *when* and *how* to cheat" (9; italics in the original). Filmmakers and cinematographers who are used to the traditional framed cinema format must learn to deal with a complete viewing space, a 360-degree round in which the viewer sees everything around her, possibly including the camera itself. There are different options for erasing the camera: someone can wear the camera on their head (figure 2.9), or the

Figure 2.9
The position of the camera in the production of 360-degree video, as opposed to VR. Here, an actress is equipped for filming *EWA, Out of Body* by Knattrup-Jensen, Damsbo, and Makropol (2019) with the camera mounted on the actor's head. Photo by Hind Bensari.
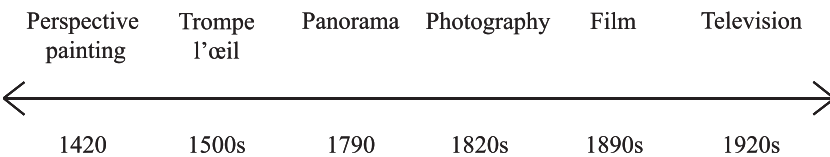
filmmaker can place the camera on a tripod and then remove the traces of the tripod in postproduction (and there are several examples in which ghostly evidence of the camera is still present).

Filmmakers making 360-degree videos still determine what the content of the whole scene is. Although they cannot control precisely where the viewer will be looking at any given moment, they can employ various techniques to try to direct the viewer's attention. They can also cut or fade from one scene to another or even move the camera during the shooting, just like in traditional film. Technological limitations also mean that the viewer of 360-degree video does not have as much visual freedom as she does in VR, where she effectively becomes the camera. In VR, both the orientation and the position of the camera are aligned with the user's phone or headset. In 360-degree video, the viewer can change her orientation, but she cannot interact with the people and objects in the video; she cannot walk among or around them. Everything in a 360-degree video remains distant from the viewer, no matter how near she might seem to be.

Reality Media as Remediations

We have now fast-forwarded through about six hundred years of reality media from the Renaissance to the present. Figure 2.10 presents a timeline for the media we have discussed.

As each new reality medium appeared, it borrowed from earlier media, while at the same time claiming to improve upon its predecessors. Renaissance painting used techniques of linear perspective to make the image realistic from a particular viewpoint. But a painted canvas on the wall was only convincing if the viewer did not look beyond the frame. The trompe l'oeil painting pushed the idea of perspective illusion further by situating the painting on a wall or ceiling to look like an extension of the architecture

Perspective painting	Trompe l'œil	Panorama	Photography	Film	Television
1420	1500s	1790	1820s	1890s	1920s

Figure 2.10
Timeline of reality media.

itself. A painted panorama was a trompe l'oeil extended to a 360-degree format. Photography remediated perspective painting in a different way by bypassing the painter, and film remediated photography by adding motion. Each reality medium added technical or technological innovations to previous forms. A linear timeline, however, cannot capture the complex remediating relationships among all these media.

As each new reality medium appeared, it borrowed from earlier media, while at the same time claiming to improve upon its predecessors.

Some reality media are static and others dynamic. Some consist of fixed images, including painting, panoramas, and photography. Some consist of moving images that are not under the viewer's control, including film, television, and 360-degree video, and also a number of "failed" media that were once popular but are now forgotten, such as the zoetrope and phenakistoscope. All these are dynamic, but not interactive. Broadcast television images can be live, but the viewer still has no control over what she will see. Like film, the images in 360-degree video are prerecorded, but the viewer has more control over the point of view. True VR belongs on the far end of the spectrum because it is potentially fully interactive.

Another distinguishing feature is whether the medium is unified and immersive or hybrid and partial. This spectrum is similar to the Milgram and Kishino spectrum, in which all mixed reality forms are hybrid and VR is unified and immersive. VR creates a complete graphic world, which is all the user can see, but in all forms of MR (mixed reality) the user sees at least part of her lived world, as well as the virtual objects or information. We can plot many other reality media on the same scale. Painting, trompe l'oeil, photography, and television are all partial. A painting in oil is a unified representational medium, but when hung on the wall of a gallery, it becomes part of a larger hybrid scene for the visitor. Painted and photographic panoramas, 360-degree video, and VR are fully immersive. Film viewed in a theater is not fully immersive, but by darkening the rest of the hall this medium effectively shuts out most of the physical world.

In one sense, every reality medium that we have been discussing is only two-dimensional. They all reduce images to a flat (or perhaps curved) screen to be viewed. The screen may be very large, as in the case of IMAX screens in theaters, or as small as a smartphone's screen or the eyepieces of

a VR or AR headset. But the three dimensions are always reduced to two. The distinctions here have to do with how the images were produced and when. Two-dimensional flat reality media were made by drawing on a flat surface (painting) or reducing the three-dimensional world to a flat image photographically (in photography and film). Three-dimensional reality media use techniques of computer graphics to represent 3-D models and then reduce them. This gives the image a different texture: 3-D animation in Pixar films is easy to distinguish from the 2-D animation of decades of cartoons, from *Gertie the Dinosaur* to Disney's films of the 1960s and 1970s. And 3-D models make it possible to create perspective images in real time so that users can walk around objects in VR and even pick them up and move them. Unlike the shadows to which Gorky compared film, 3-D objects in VR can themselves cast moving shadows in their scene.

As we have noted, VR is often portrayed as the ultimate reality medium, but so were perspective painting, photography, and film in their time. It is certainly true that VR is unique in its capacity to fashion an interactive, responsive 3-D world around the user. But every one of the earlier reality media also developed a unique aesthetic, derived both from its formal qualities and its evolving place in our media culture. The differences in formal features, audience, and cultural function explain why so many of these media still survive. Of the principal reality media that we have listed, only painted panoramic exhibits are more or less obsolete. All the others still form part of today's complex media economy and are still entering into cooperative and competitive relationships with each other. Some of these media are certainly less popular than they once were. Broadcast and cable television must compete for audience and cultural status with streaming video such as YouTube and with social media in general. And all reality media have developed digital versions, which has led to hybrids. If we watch a movie on a tablet, some of the features of film as a reality medium are changed or lost. And if we watch a movie in a virtual theater while wearing a VR headset, what reality medium is that?

All remediated reality media and their hybrids redefine reality in the same way that film did when *The Arrival of a Train at La Ciotat Station* astonished the Parisian audience in 1896—that is, by asking the audience to compare the new construction of reality that they have to offer with an earlier, now familiar medium. When he viewed the Lumière brothers' films, Gorky was clearly aware of their relationship to photography—so much so

that he was disappointed rather than astonished: "There are no sounds, no colors. There, everything—the earth, the trees, the people, the water, the air—is tinted in a gray monotone: in a gray sky there are gray rays of sunlight; in gray faces, gray eyes, and the leaves of the trees are gray like ashes. This is not life but the shadow of life, and this is not movement but the soundless shadow of movement" (Gorky [1896] n.d.).

Gorky understood these differences between his lived world and the world of film as failures. Film did not live up to its implied promise of reality. Other early accounts of film emphasized instead how lifelike it was, which is presumably how the La Ciotat myth gained currency, although Gunning argued that unlike Gorky, most audiences of early films understood and appreciated both the apparent realism of these films and the obvious fact that film was a medium. Over the following decades, the shadowy silence that disturbed Gorky developed into the characteristic film aesthetic of the silent period, both realistic and symbolic and abstract at the same time. We have a different understanding of that aesthetic today because of the development of film from the talkies on and because of subsequent reality media, especially television and now VR. Enthusiasts of VR today fall easily into the rhetoric of the La Ciotat myth (that VR is or can become unmediated reality), which does not allow them to fully appreciate the texture of VR as a medium. In the following chapters, we turn to the technical qualities of both VR and AR that help to define their aesthetics.

Reality Media

Augmented and Virtual Reality

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