In the kingdom of shadows

Towards a cognitive definition of photographic media

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The essay identifies some of the cognitive processes underlying the appeal of photography and film. Unlike painting or drawing, the photographic media are primarily indexical, with the implied physical connection between object and image. Like painting however, photographic media are also iconic, in the sense of perceived resemblance between object and its representation. Also, the restricted angle of vision caused by the photographic/cinematic frame privileges the observer, creating composition and semantic tensions between objects within the frame. These properties of the photographic media are cognitively supported by human instinctive alertness to indexical signs and moving objects, by the assumption of identity between objects that happen to be similar, and by innate preferences for viewpoints that allow the observer the advantage of seeing without being seen. It is the evolutionary stability of these cognitive dispositions that gives photography and film their universal appeal.

1. Introduction

Tool-making technologies develop as a response to technical needs and challenges, while information technologies respond to human cognitive needs such as curiosity about the world and enjoyment of fiction (Dutton 2009: 103–134). This essay attempts to identify some of the cognitive processes and corresponding technologies underlying the historically unprecedented appeal and cultural success of the photographic media, including still photography and film. It will be argued that the attractiveness of photographic images results from an interaction between their unique technical properties and innate cognitive preferences and predisposition involved in processing visual information. In particular, the technological and cognitive properties of the photographic media discussed below include the following points:

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- the indexical character of photographic images, involving the physical connection between object and image, underpinned by human instinctive alertness to indexical signs;
- the illusion of realistic movement achieved in film, which taps to human automatic attention to moving objects;
- the iconic character of photographic images, involving perceptual resemblance between object and image, supported by a cognitive tendency to assume identity or direct connection between objects that happen to be similar;
- the photographic frame, which privileges an individual observer by limiting the angle of vision and creating composition and semantic tensions between objects within the frame. Cognitively, the "window" of the frame taps to human innate environmental preferences to seek useful information by means of adaptively advantageous opportunity of seeing without being seen.

2. Shadows on the screen

After attending the screening of the Lumière brothers' films at a Russian fair in July 1896, the writer Maxim Gorky summed up the nature of the new medium in one sentence: "Last night I was in the Kingdom of Shadows" (Harding and Popple 1996: 8). The metaphoric phrase evokes mythical concepts of the Other World such as the Greek Hades described by Homer, populated by living "shadows" of dead people (Homer 1980: 115). The Lumière brothers' films that Maxim Gorki saw had only been made a year earlier, and the people shown in them – workers leaving the factory, passengers getting on and off the train, August Lumière and his wife feeding their baby, and so on – were, unlike the shadowy ghosts from the Homeric myth, still alive in the real world. However, Gorki's shadow metaphor was apt, because what the early cinema audiences saw on the screen were not living people and real objects, but their immaterial if perceptually real shadowy equivalents, the light effects produced by the camera and the projector. While natural shadows accompany contiguously the solid objects that cast them, recorded cinematic shadows are, like the "shadows" of the dead in Homer, referentially displaced visual signs, causally connected with their objects only at origin. It is the displaced nature of photographic images, their paradoxical combination of direct connection with and temporal and spatial distance from the represented objects, that for subjective reasons accounts for the nostalgic and sentimental value attached to family photo albums and home videos, which indeed often show "living shadows" of people long dead.

Just as the optical properties of the ubiquitous natural shadow have universally been transformed into a powerful and versatile symbol in folklore, visual arts, and literature (Stoichita 1997), so Maxim Gorki's metaphor of cinema as the kingdom

of shadows was likewise extrapolated from the very physicality and technicality of the new medium. In a pre-digital age both still photographs and the animated photographs of cinema were generated by a photochemical process of exposing to light silver salts (silver halides) covering a celluloid strip in the camera, which darken in the presence of light. After developing and fixing the photosensitive image (to stop silver salts from further darkening), the resulting negative was re-photographed to make a positive, realistic looking black-and-white print, a second-generation photograph or film, which is what viewers contemplated in their photo albums or enjoyed projected onto a cinema screen. In other words, first the camera uses light to transform solid objects from the outside world into their two-dimensional negative shadows on the celluloid strip, and then the light in the projector casts these recorded shadows as enlarged second-generation positive shadows onto the cinema screen. In the optical sense, therefore, the experience of cinema is indeed the experience of layers of shadows.

Capturing shadows is essentially the same in digital photography and film, even if the method of recording light effects is electronic rather than chemical. The early analogue video systems worked by electronic scanning, in which photosensitive diodes converted light to an electric impulse, while the resulting set of values was stored on a VHS tape (or some other storage device). The now practically universal digital cinema and photography employ a CCD (charge-coupled device) to record objects from the outside world, and they digitise the output by converting it into a stream of integers (whole numbers). These integers are stored as a bitmap, which is composed of a grid of picture elements (pixels), each with an integer assigned to it (Gaut 2010: 9–10, 14). Digital cameras record light effects just like the old photochemical cameras, although the underlying physical mechanisms of capturing images are different. The main reason why the photochemical process has been replaced by a digital one is practical and economic: digital cameras produce and copy their images practically at no cost (no need for film stock), and instantaneously (no need to wait until the negative is developed and re-printed).

A finished digital photograph is also in many respects not unlike a traditional photograph. The latter is comprised of sometimes billions of individual grains of silver salts as part of the photosensitive emulsion. These grains are the chemical equivalents of pixels in digital photographs. When a traditional photograph, or its negative, are blown up to a sufficient magnitude (as in projecting a 35-mm print onto a cinema screen), the individual grains are often discernible, which gives the viewers a characteristic and often much appreciated grainy "feel" of an old movie. With sufficient magnification the photographed objects can lose their distinction to the point of being unrecognizable. In Michelangelo Antonioni's film *Blowup* (1966), a photographer, played by David Hemmings, keeps enlarging the image that he thinks shows a murder, until the grains become so large as to blur the objects

entirely and render them unrecognizable. What the photographer hoped would be an incriminating record of a crime finally becomes a piece of abstract graphic art. A similar effect can happen in digital photographs, when a sufficiently large magnification can reveal a regular mosaic of rectangular pixels, while making the contours and textures of photographed objects disappear.

3. The indexicality of photographic media

Whether the underlying technology of capturing light effects to represent the visible world is photochemical or digital, the huge popularity and cultural success of the photographic media have depended mainly on the support of the perceptual and cognitive processes involved in contemplating photographic images. Quite apart from *what* photographs or films show, there is something uniquely appealing, or *photogenic*, in the photographic images themselves. Arguably, the communicative effectiveness of photography and film is ultimately a function of the media's inherently indexical character, combined with human innate responses to indexical signs. Just as the photographic image is physically caused by light reflected from an object, so an index, in C. S. Peirce's classic formulation, "is a sign which refers to the Object that it denotes by virtue of being really affected by that Object" (Peirce 1998: 143). By being "really affected" by its object, an index thus testifies to the objective existence of the object, whether it is perceived by an observer or not (Goudge 1965: 53, 66; Jappy 2013: 84–90). Analogously, systems theory of communication defines index as a physical change in the environment produced by any reacting system (Sadowski 2009: 34–36). Thus, a crater in the ground caused by an exploded bomb is an index of that bomb, and loud music audible from an adjacent apartment is an index of a stereo system (and by extension of people using it) located in that apartment. Indexicality understood as causality treats any physical change in the environment as a sign pointing to a usually displaced object that subsequently determines the meaning of an index to a cognitive system, such as an animal or a human being, capable of perceiving and interpreting an indexical sign. In other words, as a physical extension or trace of an object an index is a referential representation of that object.

Natural shadows – the perceptual prototypes of photographic images – are in this sense indexical representations of opaque objects obstructing the light and causing a patch of reduced luminosity (darkness) on the opposite side of the light source. Unlike a bomb crater, a footprint, a smell of tobacco left behind in a room by a smoker, which are all displaced signs, a natural shadow is practically contiguous with its object, certainly in a temporal sense (a shadow does not exist without its object being present), and usually also spatially (e.g. a person's shadow is partly

removed from the person but it joins the person at the feet). As indexical signs, cast shadows thus inform us about the solid objects that produce them, even if we do not see the objects themselves, as when the presence of a person hiding behind the corner of a house is betrayed by his or her shadow cast on the pavement. In the surrealist painting *Melancholy and Mystery of a Street* by Giorgio de Chirico (1914), the atmosphere of eeriness and anxiety is in no small measure due to a threatening human shadow emerging from behind a building, opposite a silhouette of a girl rolling a hoop and obliviously heading towards possible danger.

For evolutionary reasons indexical signs tend to provoke instinctive, goose bumpy sensations combined with anxious inferences about the identity and possible intentions of their spatially displaced originals. We fearfully become aware of someone's presence in the dark by the sound of their breathing, and we are making a reasonable deduction that a cracking sound of a broken twig in the forest may be a sign of an approaching large animal or a stalking human. In fact, indexical signs tend to stimulate the imagination and emotions more when they appear on their own than when they are perceptively accompanied by their referents. In the latter case what we see is what we get, so there is little else left to feed the imagination. A "complete" sign, one that does not point to anything but itself, is part of contiguous experience, by far the most common form of interaction with the world and a prerequisite for cognitively more advanced forms of communication based on displaced reference using indexical, iconic, or symbolic signs.[1] A visible figure casting a shadow is thus a complete sign, a perceptual whole in which the indexical shadow is usually ignored, our attention being concentrated on the figure as the main subject. This is probably why cast shadows are rarely represented in painting, where they are considered superfluous and redundant, unless employed for specific symbolic or stylistic reasons (Gombrich 1995: 19–21). We may not be missing a shadow of a real person or of a painted or photographed object, but we are certainly missing an object if all we see is its shadow, a feeling captured in the earlier-mentioned painting by de Chirico.

Indexes and their often displaced originals are instinctively treated as gestalts, as co-present and consubstantial wholes, which they usually are in real life as part of the ubiquituous contiguous communication. A shadow is inseparable from the object that casts it, just as the weathercock (Peirce's example) points in the direction of the blowing wind. C. S. Peirce indeed stressed an "existential relation"

1. Strictly speaking, any contiguous sign is also by default an index, and in a double sense. First, any material object is a result of an infinite causal chain of transformations of matter according to physical laws; and second, the perception (in visual modality) of a contiguous object depends on a "photographic" process of using light to form an image of the object on the retina inside the eye, and of transforming photons into nervous signals to be interpreted by the brain.

between index and its object, using photography as an example: "…we know that [photographs] are in certain respects exactly like the objects they represent (…), that they were physically forced to correspond point by point to nature" (Peirce 1998: 159). The perceived identity between a photograph and the represented object indeed makes photography "a supremely realistic medium" (Walton 2005: 70). This was realised immediately after the photographic era was launched in 1826 by Joseph Nicéphore Niépce's first camera picture using the silver nitrate process (Briggs and Burke 2005: 133). Niépce's younger partner Louis Daguerre referred to photographic images as "imprints of nature", while Edgar Allan Poe, in an article published in 1849, called "the Daguerreotyped plate (…) infinitely more accurate in its representation than any painting by human hands". Long before the concept of indexicality was devised to account for the "existential relation" between index and object, Poe found that "the closest scrutiny of the photographic drawing discloses only a more absolute truth, a more perfect identity of aspect with the thing represented" (Trachtenberg 1980: 38).

Similarly, the photographer Edward Weston (1886–1958) praised the new medium for its "amazing precision of definition, especially in the recording of fine detail", which results from "the mechanics of the process [that] cannot be duplicated by any work of the human hand" (Trachtenberg 1980: 172). The poet Paul Valéry (1871–1945) likewise described photography as an objective process of illustration that mirrored physical acts. He argued in favor of "a sort of Philosophy of Photography", which could "revive, if not rejuvenate, the ancient and difficult problem of objectivity", by "ascribing objective value to every impression whose replica, whose likeness, we are able to capture – impartial light being the only intermediary between the model and its representation" (Trachtenberg 1980: 196–197). Making a point of the fact that the lens, the basis of photography, is in French called the *objectif*, the influential film critic and theorist André Bazin stressed that the originality of photographic media, as distinct from originality in painting, depends essentially on the "objective character of photography", in which "between the originating object and its reproduction there intervenes only the instrumentality of a nonliving agent", and whose images are "formed automatically, without the creative intervention of man" (Bazin 2005: 59). For Susan Sontag too a photographic index is "a trace, something directly stencilled off the real, like a footprint or a death mask" (Sontag 1978: 154).

Unlike a painted image or a verbal report, a photograph is therefore an objective proof of the object's existence (as in CCTV camera footage accepted as forensic evidence), because the relationship between index and object is causal and physical, at least at origin. Despite being spatio-temporally removed, for compelling psychological reasons things represented in photographs and films seem uncannily still to be "there", as the viewer subjectively "re-attaches" the missing object to its

indexical image. André Bazin went so far as to insist that for the viewer "the photographic image is the object itself" (Bazin 2005: 60), thus endorsing the "naïve" reactions of early cinema audiences, who reportedly often screamed and dodged when a train hurtled towards them on the screen (Jarvie 1987: 50). Sustained stress and frustration too can both diminish critical sense by making a person mistake displaced indexes for their originals, and weaken the need to suspend disbelief, normally used to enjoy fiction as fiction, when contemplating indexical simulations of life on the screen. In Woody Allen's film *The Purple Rose of Cairo* (1985), the unhappy housewife Cecilia, played by Mia Farrow, finds emotional fulfilment in watching every night romantic comedies and musicals in a local cinema, until a dashing young hero, played by Jeff Daniels, "steps off" the screen to join Cecilia in the real world, later to invite her to pursue romantic adventures with him in his own shadowy reality inside the screen.

The irrationality of the photogenic effect bears a striking resemblance to the universal phenomenon of contagious magic identified by nineteenth-century anthropologists (Frazer 2002: 11), which too relies on mistaking displaced indexes for contiguous objects. According to James Frazer, this widespread way of thinking follows the psychological law of contact or contagion, based on the belief that things that once have been in contact with each other remain always in contact, even when physically separated. In this way a sympathetic, "magical" link is assumed to exist between a person and a severed part of that person, such as hair, nails, or teeth, or some physical trace left by the person, such as a footprint. In his monumental study of magic and religion Frazer quotes it as a world-wide superstition that by injuring footprints one could also injure the feet that made them. For example, the Australian natives from south-east of the country believed that a man could be harmed by placing pieces of quartz, bone, or charcoal in his footprints. The aboriginals of Victoria would put hot ambers in the tracks of the animals they were pursuing (Frazer 2002: 44). As in contemplating photographic images, in contagious magic a person acts towards a displaced index as if it was the object itself. This kind of magical thinking appears to assume the "eternal present", in which a perceived index becomes one with an absent object. This default mindset seems reluctant to accept the passage of time and the destruction it often brings – a disposition only overridden by a conscious effort to learn the objective cause-and-effect links between objects and events in the world. But even for an otherwise scientifically and rationally inclined person the residual contagious magic is often too compelling and too emotionally gratifying to resist, as evidenced by our nostalgic, sentimental attachment to mementoes, keepsakes, family photographs and home videos.

4. Animated photography

Both still photography and film remain closely related as indexical media – the only difference being the added illusion of movement in the latter, which technically consists of the effect of the intermittent flashing of still photographs supported by the phenomenon of the persistence of vision, in which the perception of an object continues for a split second after the rays of light proceeding from it have ceased to enter the eye (Thompson 2003: 15). In the late 1880s and early 1890s several inventors worked on the mechanics of animated photography: W. K. L. Dickson in the Thomas Edison company; Louis Le Prince and the Lumière brothers in France; the Skladanowski brothers in Berlin; and Robert W. Paul and Birt Acres in Britain. The possibility of film camera rested on the confluence of several inventions: short enough exposure times to allow multiple exposures per second (silent films were generally recorded at 14 to 16 frames per second); the invention of a transparent, flexible film base (developed by George Eastman in 1889); and the adaptation of the Maltese cross drive mechanism, previously used in the machine guns and sewing machines, to advance the film and hold it still for a fraction of a second (Thompson 2003: 17–20). As in still photography invented earlier in the century, the immediate popularity of moving pictures was mainly due to their perceptual and cognitive appeal: for evolutionary reasons motion (quite regardless of *what* is actually moving) automatically catches our agitated attention (Schiffman 1996: 195). Throughout our prehistory moving, self-propelled, laterally symmetrical objects tended to be either animals or other humans, and it paid in survival terms to keep a watchful eye on what these objects were doing: did they behave like friends or enemies, did they look like potential sources of food or like potential predators. Our vision is instinctively alerted by movement, as evidenced by the greater effectiveness of flashing neon signs over still lights, by TV commercials over printed ads or billboards, and by the higher visual appeal of performances in motion such as theatre, dance, and cinema over painting, photography, sculpture, or architecture (Arnheim 1960: 304).

5. The iconicity of photographic media

Despite its effectiveness in pointing reliably to a causally linked referent, displaced indexicality has its limits as a form of communication. Index alone can often imply its object only vaguely and imprecisely, leaving too much to conjecture and speculation. An imprint of a shoe sole in soft ground clearly indicates a past presence of a walker, but not much beyond that: the shoe size can dimly imply the walker's age, but not his or her sex, physical appearance, or any other of the many important personal characteristics and circumstances of life. Similarly, a smell of tobacco in

a room undisputedly confirms a recent presence of a smoker, and this is more or less where the communicative power of this index stops. On the other hand, the cinematic image – with its high degree of realism and objectivity based on the assumption of the physical connection with the represented objects, plus the illusion of movement, which further enhances the representation of the animated world – depends on something more than indexicality. Photographic media owe their communicative effectiveness also to their high degree of perceptual resemblance to the represented objects. In other words, in addition to being indexical photographic images are also iconic (Peirce 1998: 143; Sadowski 2009: 36–38; Jappy 2013: 79–84). Unlike an index, an icon is not caused by an object it represents, but is related to it through perceived similarity. For example, a person's shadow is an index caused by and therefore physically inseparable from that person, but a painted portrait (an iconic sign) only resembles the person it is referring to. Apart from the similarity between the painted portrait and the sitter, which is formed in the minds of those contemplating the picture, there exists no direct, physical connection between the two. Iconicity in the above sense is abundantly illustrated in human communication and culture, most spectacularly by figurative drawing, painting, and sculpture.

In fact, all signs are polysemiotic, in that they embody characteristics of more than one type of sign within their structure, thus enhancing their communicative power. As an index, a single speech act testifies to the existence of a speaker, yet it consists mainly of symbolic, arbitrary signs, where the connection between the form of the sign and its meaning is based on social convention, and it often includes an expressive iconic dimension on the levels of phonology, morphology, and syntax (Anderson 1998). In visual communication too, when an index such as a photograph resembles its object perceptually, we are talking about the iconic quality of an indexical sign, or about iconic indexes (Sadowski 2018: 23–27). C. S. Peirce was probably the first to stress that icon and index can be combined in one sign, and that it is actually the indexicality of the sign that makes iconic quality possible:

> In so far as the Index is affected by the Object, it necessarily has some Quality in common with the Object, and it is in respect to these that it refers to the Object. It does, therefore, involve a sort of Icon, although an Icon of a peculiar kind; and it is not the mere resemblance of its Object, even in these respects which makes it a sign but it is the actual modification of it by the Object.
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> (Peirce 1998: 143; Jappy 2013, 85–86)

In photography it is precisely the physical connection with the represented object that accounts for a high degree of verisimilitude. Accordingly, for Peirce a photographic image is a classic instance of an iconic index: "A photograph, for example, not only excites an image, has an appearance, but, owing to its optical connection with the object, is evidence that that appearance corresponds to a reality" (Peirce

1998: 145; Carroll 1995: 69). In his study of Peirce's visual semiotics, Tony Jappy sums up the iconically indexical nature of photography:

> In short, the image is formed by the iconic elements participating in the photograph, while the physical connexion is the truly existential determination of a sign whose complex dynamic object is a striking event associated with some photographer's desire to record it for posterity. In a similar fashion, a footprint in the sand, another index, will indicate that some animal or other has walked in the area, but it is the actual shape of the footprint, its iconic content, that will enable us to determine whether it was made by a turtle, a bird or, as Robinson Crusoe discovered, a human being. (Jappy 2013: 87)

Iconic indexicality covers a fascinating area of visual culture, including some of the most perceptually and cognitively powerful media and art forms such as the shadow theatre, magic lantern shows, silhouette portraits, the camera obscura, photography, film, and television. It is the combined effect of iconicity and indexicality that makes these media all the more efficacious in stimulating our senses, emotions, and imagination than the purely iconic art forms such as drawing, painting, and sculpting. The iconic indexicality of a cast shadow, a shadow puppet, a silhouette portrait, or a photograph implies not only iconic resemblance (which is often much higher than in most realistic painting), but also physical identity with the represented objects in a way never attained by purely iconic media. In other words, iconic indexical media are truthful in depicting already existing realities, whereas iconic media are fictional in simulating often non-existent, imagined realities.

Incidentally, the communicative power of iconic signs seem to be enhanced by another universal "irrational" disposition, identified by anthropologists as homeopathic magic. Just as in contagious magic a displaced index is treated as a contiguous sign, whereby doing "harm" to one's footprint is believed to affect the person who made the footprint, so homeopathic magic is based on the principle of similarity, whereby things that resemble one another are believed to possess an invisible but direct link, so that by manipulating the icon one can also manipulate the object depicted by the icon (Frazer 2002: 12). Like an angry crowd burning a hated public figure in effigy, or a lover "punishing" a disloyal partner by tearing up his or her photograph, so homeopathic, or imitative magic assumes control over the object by controlling its image. In Ovid's *Metamorphoses*, the sculptor Pygmalion famously creates an image of a beautiful woman, prays to Venus for a bride modelled after the image, and has his prayer granted when the goddess obligingly turns the cold ivory into a living body (Ovid 2002: 303). Ovid's myth plays on the universal irrational disposition, underlying the homeopathic magic, that identifies an iconic sign with its own referent (found also in idolatrous worship of religious images). But however emotionally gratifying, mistaking icons for

objects remains an illusion, as artists more sober than Pygmalion can confirm. To a lady who once complained about Matisse's painting that "the arm of this woman is much too long", the painter famously replied: "Madame, you are mistaken. This is not a woman, this is a picture" (Rogers and Rogers 1986: 105).

6. The photographic frame

Another important feature of the photographic image, still or moving, to attract and hold the viewer's attention is its horizontally rectangular shape, the frame, which limits the natural angle of vision, enhances concentration, determines the image's composition and creates semantic tensions between objects enclosed within the frame. While the two naked eyes capture a horizontal field of vision of over 180 degrees, the normal camera lens (55 mm) permits only a 43-degree viewing angle, while a 300-mm telephoto lens further narrows it down to a mere 8 degrees (Solso 1997: 21–25). The horizontal and vertical edges of the photographic frame separate the represented scene from the rest of the imagined and real world, and in the process create a composition, in which selected visual elements assume meaningful spatial relationships and tensions, absent in the scene when viewed with a naked eye. In other words, the framing not so much highlights meaningful relations between objects as creates relationships that did not exist before, even when the meaning-creating process is unplanned and inadvertent, as in casual snap-shot photography and spur-of-the-moment smartphone video capture. In professional photography and cinematography, where framing is usually carefully planned and controlled, a setting is transformed into an aesthetic object, in which the frame, according to the psychologist of art Rudolf Arnheim, "is no longer considered an integral part of the social setting, but a statement about that setting". In other words, framing turns a scene into a work of art (Arnheim 1982: 52).

Choosing the framing as the basis of the picture's composition started with Renaissance panel painting, when the humanist Leon Battista Alberti compared the picture frame to an open window through which an artist saw what he wanted to paint (Alberti 1956: 56). In addition to creating a composition from the selected parts of the visible world, both the window, the framed view of a painted or photographed scene, and a cinematic screen also offer the viewer an advantageous point of view of prospect and refuge, one that allows an opportunity of seeing without being seen. According to the prospect-refuge theory, people innately prefer edges rather than open spaces for better visual access to an area, and spaces that provide a covering over the head (a roof, a tree canopy etc.) to ensure privacy and safety (Orians and Heerwagen 1992: 571). The vertical edge of a bush and a horizontal covering of a tree branch as the optimal hiding and viewing position may well be

the evolutionary prototype of a window and a picture frame. The evolved responses to landscapes make a contemplation of enclosed views more pleasant and enticing, including also what the evolutionary psychologist Stephen Kaplan calls "mystery", defined as the promise of more information as one ventures deeper into the landscape, physically or imaginatively (Kaplan 1992: 588, 594). The use of geometric perspective in Renaissance painting, and the automatic recording of cues of depths in photography to simulate three-dimensional space in a flat picture, are thus designed to invite the viewer to explore the virtual scene within the frame as part of the vicarious experience that imitates the exploration of the natural environment in search of optimal habitat by our ancestors. For deep cognitive reasons, the photographic "view from a window", coupled with the indexical and iconic qualities of the image itself, thus becomes what is probably the most appealing and perceptually powerful visual medium ever invented, or, given the stable elements of human innate cognitive dispositions, ever likely to be invented.

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