Art in an age of science and technology

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The US film and video critic Gene Youngblood once wrote that "all art is experimental, or it isn't art." Surveying the art of today one is quickly given to agree with this statement! How difficult it is to characterize the perplexing profusion of styles, the range of techniques, and the variety of cultural and political statements artists present to us! This diversity, as my discussion today will show, often demonstrates Youngblood's assertion that all art is experimental —for artists today are not only using various technologies, they are also profoundly changing art as they do so. Within this context, as I will discuss, even when technology per se is not the focus, we frequently find that the technologies of our time offer tantalizing ways of framing statements and experimenting with visual possibilities, a point Joe Tillson alludes to when he includes an ecktachrome film strip in a piece he calls *Transparency: The Five Senses: Taste*.

Indeed the new materials artists use today have radically transformed art, and our globally-linked planet has brought the plurality of artistic forms, the diversity of styles, the ways in which statements about art can be formed and framed to the surface. Within this we find that the wide array of technical practices, this virtual reality theatre being one example, now make it easy to see that technology has had a tremendous impact on how we engage with art, how we engage with the question of what art is, and how we view the many ways artists exploit technology in our time.

New tools, of course, have always resulted in new forms and, in the largest sense, we can say that technological innovations add imaginative possibilities to the artistic toolbox. When we place the results into a mix that includes social, cultural, political, and scientific contributions we find the enlarged vantage points new technologies offer are even more intriguing.

Perhaps as striking as the number of ways in which artists use technology is that forms of experimentation, like artistic goals, vary widely today. Given this it is not surprising that, sometimes, technologically informed work simply excites our senses and, at other times, even an educated viewer may wonder how best to address a work he or she simply does not understand. There is also the challenge of engaging with work that invites us to be participants rather than passive spectators. And, of course, work presented in more traditional ways, so to speak, continues to raise traditional questions about what art is. One might ask: Is it the visceral quality of a work that excites us or will we more fully experience an artist's intention if we read the work as a text and interpret the levels of meaning embedded in the project? Then, again, perhaps an interpretation based on ferreting out meaning compromises key elements that might be optically-centered or intended to emotionally-charge our experience?

While I won't pretend I can unify this broad spectrum of possibilities, I do want to speak about the imaginative ways in which artists have exploited technological innovations and the richness and diversity

in both art practice and art discourse that has resulted from these exploits. Before surveying work and issues that reflect on the technological leaps of our time, let me emphasize that technology is difficult to bracket in thematic and contextual terms because technology often enables artists to move thematic and contextual possibilities into uncharted domains, as I will show. As a result of their successful experiments, as I will also show, artists produce artifacts that document how they have transformed potentials they sensed within new materials into forms that state, at least to some degree, how they pushed these materials to their limits.

For example, although my focus will not be on oil paint in this lecture, I want to nonetheless first state that it was in the fifteenth century that this then new technology captured the attention of artists. These artists were immediately drawn to the medium's ability to realistically model form, graduate tone, and catch sheen — and were likewise enthralled by the visual evidence that oil-bound pigments could capture life-like qualities and add a life-like vitality to paintings. It was as if viewers could suddenly see, touch, and feel texture, light, reflection, and colors — a point you might want to reflect on as you view this detail on the right from the Ghent Altarpiece, completed in 1432 by Jan van Eyck – where you see the emperor's hand holding a clear, crystal wand and, on the left, a detail in the convex mirror that is found in Jan van Eyck's Arnolfini double portrait, completed in 1434.

As you may recall, Jan van Eyck's mastery of the oil technology led early art historians to credit him with the invention of oil paint. I've begun with this example to underscore that innovation is in no way specific to our time. Innovative technologies emerged prior to oil paint and they continue to emerge today. Moreover, as history shows, artists are prone to employ materials new to them — in all periods — and driven to manipulate their tools — perhaps by nature — as they aspire to turn aspirations, inspirations, possibilities and ideas into forms of communication.

In an effort to illuminate why artists sometimes invent new technologies and sometimes bring options invented by others into their the artistic repertoire, I will divide my lecture today into three parts: The first section will present five artists to quickly convey how difficult it is to characterize how artists of our time might employ technological breakthroughs in their practices. Next I will attempt to bring some useful frames of reference to contemporary innovations as they pertain to art. Finally, I will integrate some thoughts on the role of painting and the history of photography that I believe relate to how artists exploit innovative technologies today.

1. Diversity

Artistic experimentation in our time, as in earlier eras, explores notions of reality and what is invisible to us; creates fictional and idealized narratives; and probes experimental, experiential and formal relationships — while often making cultural or political statements as it does so. One of the more intriguing areas is the way practices are as likely to mimic traditional forms as they are to turn away from them. Often the two inclinations are even seamlessly combined.

For example, artists often present work that looks like a slice of reality, belying that it has been produced using image manipulation and various technological tools, as is the case in the work of the Canadian artist Jeff Wall (b. 1946). Wall is a photographer whose enormous back-lit transparencies alternate between documentary and fantasy, each mode drawing from the other. His 1993 image *A Sudden Gust of Wind (after Hokusai)*, now on the screen, is a re-creation of a famous colored woodcut print. As you can see, this panoramic image seems to present a photographed moment, for we find what appears to be a freeze-frame of papers and objects flying in a sudden gust of wind. Actually, the single moment we think we see was staged. Wall used actors and then digitally synthesized this image from around 150 photographs taken separately and over a five-month period. This kind of seemingly split-second picture is conceived over so long a period of time, and requires such complex direction, that Wall sees his work as closer to film than to photography. He also has said he draws on skills akin to those of a painter, novelist and filmmaker.

Another Canadian artist, Char Davies, uses digital manipulation to incorporate a quite different experience of nature into her work. Her awarding winning OSMOSE is an immersive virtual environment that explores the inter-relation between exterior nature and interior self. Her aesthetic, first developed through painting, emphasizes the luminosity and ambiguity of the environment in which an immersant — the term applied to the user — experiences the symbolic realms of ten different universes - consisting of Forest, Clearing, Stream, Leaf, Pond, Earth, Abyss, and so forth. Unlike the staged moment Wall presents, Davies' aim is to create a space for a body-centered experience that is experienced in real time, one that will allow the immersant to dissolve the boundaries Davies believes we feel between self and nature.

As you can see, the immersant wears a stereoscopic head-mounted display and a "motion-capture" vest with a breathing and balance sensor to enter into the environment, where sound programmed into the gear is also affected by the movement of the body. Finally, although multiple viewers can see the environment through 3-D glasses, only the "immersant" can have the total virtual reality (VR) experience at any given time.

Davies fascination with light and nature is quite unlike that of James Turrell, although both artists aim to produce interactive work that attempts to heighten the participant's awareness of his or her own senses. Perhaps this is because Davies aspires to project transparency and Turrell's medium is light. Although he is probably best known for the soon to be opened Roden Crater, his work in general explores the relations it poses among light, space, and the viewer. He also explores human perceptions of light and color in ways that stress the visual and metaphorical potential of natural and humanly-made light. Generally Turrell relies greatly on science and technical information when formulating his work, but he is also quick to point out that his projects are not scientific.

The Roden Crater project, located in Flagstaff, Arizona and scheduled to partially open this year, is the kind of space that seems to defy words — and it hardly appears technological. Its earthy tones might best be described as a reflection of Turrell's deep interest in the interplay of light, space, and the viewer. I included this earthwork in my lecture to underline that, although Roden will be swept clean of references to the artist, art objects, and art institutions once the crater is crafted into a combination of earthwork, sculpture and architecture, the enterprise is, nonetheless, a very high tech venture. Currently the crater bowl is being re-shaped, a task that requires a tremendous amount of earth removal. Later

construction will penetrate deeper into it and carve out various spaces such as the Alpha Tunnel, an 850-foot passage cut through the mountain, which is fully wheelchair-accessible and will convert to a skyspace, a pinhole camera, and a naked-eye telescope.

One could say that Turrell's glorious work with the Crater combines both ancient and modern tools and perceptions of the landscape. In terms of art, this makes the monumental scale and conception of his non-traditional project exemplary for several reasons. One is that it is a form embedded in a natural setting that does not commemorate a historical event, or a distinct achievement — other than his own. Another is that it will be a monument to human perception on several levels. In addition, despite the way the form brings ancient wonders like Egyptian pyramids to mind, it is very much a product of our time.

For example, it was Turrell's training as a pilot that enabled him to scout for a space when he aspired to find an environment where he could control the shape of the space. Then, after logging more than 500 hours of air time and a seven month search, he located Roden with its saddle-shaped dish. Even this aerial view is an acknowledgement of the degree to which technology has aided in disseminating the nature of this work, as it does the nature of the work artists now do in general.

Adrienne Klein, a New York based artist, is also drawn to scientific ideas when formulating her reflections on nature, light, and vision. Klein, however, does not stage, contrive, re-build, or present nature per se in her 1992 video installation entitled "Rods and Cones." Instead she references nature and natural processes as she metaphorically brings her art together with her scientific knowledge of how the photoreceptors in the retina work as we see. The result includes 4 video tapes and 14 color and black and white monitors, all used to offer images that pertain to how we see color in a garden at twilight during an electrical storm, when a brilliant flash of lighting illuminates the sky.

Tony Oursler, my final artist in this section, appears somewhat removed from the natural world altogether. Rather, his optics explore psychological dynamics that he believes are embedded within life today. One might say that he relies more on a 'gaze' that fails to pierce through superficial realities than on the kind of uplifting qualities Davies and Turrell hope to add to the experience of those who engage with their work. Here Oursler has projected color video eyes onto thirteen painted fiberglass globes with an accompanying soundtrack.

Reacting to this close-up scrutiny of the human eyeball the art critic Holland Cotter commented that while the art commanded attention, still

> The eyes in his installation are anxious or dull or entranced, but in almost every case the stimulant they're reacting to is artificial. Whether the subject is an evening newscast or a movie about psychosis, fact and fiction blur, reality has the flavor of a mini-series peppered with commercial breaks. And as to the notion of the eye as the window of the soul: does the weeping eye in the corner belong to a friend in distress or to an actor trained to cry on cue? It is impossible to tell. (Cotter, 1996, p. 95)

Five different artists. Five different approaches.

2.   Innovation and Frames of Reference

Each of these artists is, nonetheless, a part of our art world today, as is this diverse mixture of media and modes of expression. In considering how to group them, it seems any kind of linear presentation would miss the point and, at least in my opinion, there is also some measure of difficulty in selecting an alternative mode. One option often used is to speak about art in terms of modernism and post-modernism. While this approach is popular today, to my mind it requires one step into what I believe is a rather muddied stream. Another option, and one taken by many venues of late, is to adopt a thematic approach. Since I am focusing on technological innovation today, a traditional genre-like characterization seems inappropriate. Contextualizing work according to themes like the body, landscape, still-life, history, memory, and so forth tends to equalize work and to celebrate narrative themes more than it conveys the degree to which new technologies alter our perceptions, frames of reference, and open us to previously uncharted domains. It is for this reason that I have decided to attempt to use an approach that will continue to center on technological innovation per se as I speak.

Let me begin with two paintings by Edward Manet, Olympia and a portrait of Emile Zola. Both were conceived in the 1860s and I chose these two paintings because the portrait of Emile Zola was painted as a thank you for Zola's support of Manet's work at a time when the public was quite hostile to it. As you can see, Olympia is included in the background of the portrait. I've juxtaposed these two works — conceived about the same time —with this small slice of history to quickly remind you of what radical art of an earlier era looked like and to create a space for us to begin to reflect on how much of the work we see today would have been impossible to conceptualize in the 19th century, when these then radical paintings were conceived. The two questions I want to pose as I began to separate our time from earlier eras are: First, what does it mean to bring an enlarged frame of reference into the picture, so to speak, and, second, can we find enlarged frames of reference in artistic work today?

David Teplica's homage to Michelangelo was crafted in 1988 and offers an excellent counterpoint to the two paintings because it specifically references a historical time, in this case Michelangelo's time, and our own as well. As you can see, in his photograph, Teplica uses radiographs to make it appear that he simply x-rayed Michelangelo's image of God touching Adam to capture what lies beneath the surface of the painting as we know it. X-rays were discovered in 1896, about twenty years after the two Manet paintings. Therefore, the idea that we could find a means to non-invasively see through the opaque surface of the skin without death or before incision would have only had a symbolic meaning, or would have been seen as a metaphor at the time the two painting were conceived. At that time the concept that we could view the inside of an opaque surface like our skin in an easily engaged form did not yet exist as an actual, concrete possibility.

Of course, both photography and the x-ray would have been foreign to Michelangelo as well. This perhaps explains why comparing the Teplica and Michelangelo presentations exposes us to the fact that the two artists assume strikingly different vantage points when they divide visible and invisible domains as God touches Adam. This difference would be even more perceptible to us, as viewers, if we were we to actually look at an x-ray of Michelangelo's image. Obviously X-rays of

Michelangelo's under-painting would not expose what Teplica presents to us, but, instead, reveal how Michelangelo prepared and approached the painted surface we now see.

The transparency of the x-ray, of course, quickly added imaging techniques to scientific investigations and scientific data collection as well. These innovations, in turn, radically transformed basic medical and investigative procedures. Within this context, artists, too, began incorporating transparency and interior views, initially doing so early in the 20th century and in conjunction with emerging ideas in psychology as well as revised scientific and philosophical theories. Scientific tools have since evolved — and artistic projects have likewise mirrored these advances. What is particularly striking when we look at the artistic resonance's of exotic looking scientific images is that we are as likely to find experiential notations as formally conceived work or work that includes commentary related to cultural and social issues.

What I want to first stress is that the unexpected realization that we could access a previously invisible domain with manufactured tools and technologies we can more or less control radically changed human understandings of light, space, surface, vision, perception, and even our understanding of how our brains work! As a result, since the 1896 discovery of the x-ray, imaging tools have added a new frame of reference to human experience. This is not to say the discovery was without problems. Clearly, as we now know, invisible radiation can be deadly and radiation must be handled with great care.

Second, artists have incorporated scientific imaging technologies into their work in far-reaching ways. For example, by the 1960s Robert Rauschenberg included x-ray images of his body in a series of lithographs. More recently, artists like the photographer Gary Schnieder, the video artist Mona Hatoum, and the Australian sculptor Justine Cooper have used medical technologies to make statements about the human body, appearance, and identity (see ArtNews April 2000). For example, in one piece Coope created a self-portrait by mounting Magnetic Resonance Imaging scans of her body on clear Plexiglas sheets stacked, spaced, and hung with steel cables to create this 3D head, which presents both an interior and exterior view.

Mat Collinshaw's *Hollow Oak* draws our attention to another, and quite different innovative breakthrough that speaks to changed frames of reference. In this case, the piece underlines the degree to which we can now add movement and life-like qualities to art production. As you can see, Collinshaw literally frames the image of an oak tree within an historical object, an original wooden negative carrying case of a 19th century camera. What you can't see is the actual video that is a part of this installation. Standing in front of the actual piece allows one to perceive this video's contributions — and to thus see Collinshaw is speaking about the ways in which our perceptions of art and nature are mediated by time, culture, and technology. This comes about due to the way the image we see projected onto etched glass moves. Initially the piece appears to be a still object, even in its physical installation. This gives the object the appearance of early photography, an illusion that is slowly disrupted as we become aware of the movement of the trees and perceive the sound of the wind rustling through the leaves and the gentle bleating of sheep — qualities the video adds (p. 139, Represent B).

Collinshaw's juxtaposition of the camera and video effectively articulates how moving and static images might differ in a visual and auditory sense. Video, of course, like film was greeted with great enthusiasm when introduced because of the way the medium added movement and time to visual

presentations. By playing off the camera, Collinshaw's work brings to mind not only the camera per se but also how motion studies done with the camera in the 19th century by Eadweard Muybridge, Thomas Eakins, and others radically transformed photographic contributions by adding a sense of movement to them.

These photographic stills and others were an initial step toward bringing movement into visual art — being the first form to capture the look of actual, discrete sequences of motion (Rush, p. 15). Many of the initial studies were recorded as adjuncts to scientific research. The concepts quickly evolved into the 'illusion' of the mechanically produced and projected movement of cinema and mark the beginning of the trajectory that now brings film, theatre, video, performance and virtual reality together.

The many crossovers among the media that developed out of early photographic experimentation emphasize the importance of engaging with the history of photography here. But, before doing so, albeit briefly, I want to look at digital art, for this is another area where our frames of reference have been altered. In this domain we are likely to find static images mixed with moving images or sound — as we are to find attempts to combine natural, artificial, and virtual realities. In addition, work is as likely to be interactive as it is to be presented to a spectator much as a static painting or photograph would be presented. Moreover, even artists who do not define their work in digital terms still often rely on digital tools when producing film, video, dance, visual art, or whatever. And, at times, the possibilities seem endless.

CAVE environments are particularly tantalizing. In the CAVE it is the active viewer, the user, who controls the environment. The system updates the stereo graphics and sound according to the perspective of this participant, who wears these tracking glasses and manipulates a 'wand,' a type of 3D mouse programmed to start, navigate, and alter the images. The display transmutes in real time with the motion of the head and hand positions triggering events that are based on the program's output. Unlike a static photograph, where an image is created, presented, and observed, the CAVE offers a multi-dimensional space the active viewer can enter, so to speak.

In summary, most computer environments, such as desktops or 2D interfaces, have icons or pull-down menus that represent a direction or a goal. Virtual environments differ in allowing the objects to become the direction or the goal. The environment is a series of experiential exercises signaling the next event and — to inhabit each virtual space is to transform the projection. This requires an active and reactive decision making interpolation of sights, sounds, and our senses, for the total immersion simulates a newly created space and time, one in which all perspectives are calculated from the point of view of the user and mediated through the stereo glasses.

Margaret Dolinsky, an artist at Indiana University, uses the CAVE to strive for effects that allow the spectator to abandon the act of mere viewing, transcend simple narrative participation, and become actively engaged with this revolutionary arena. For example, her *Blue Window Pane* stages a virtual environment as a performance and a projective construction. Translated, the nonlinear, nonhierarchical structure is much like a theater in which participants navigate and grapple with symbolic events and alternative worlds. One image celebrates Man Ray and the Surrealists who were known for realizing dream worlds and exploring levels of consciousness. Another pane left hums the whispers and ramblings of the conscience and leads to a room with a spiral stairs, staring faces and pulsating sound activated graphics. The only way out is to rise above it by climbing the spiral stairs to the top, to an inner sanctum

and an icon on one of the CAVE walls transmits us there. The object, reminiscent of a religious icon in its shape and visual reflection, has a shelf that holds a golden key. By touching the key with the navigation wand the icon swells open to become a life-size arched passageway to this sanctuary.

Of course, as a virtual environment, it is not an experience of reality as we generally interact with it. It is a world in which the viewer is a user, brought into an evolving 3-dimensional experience through the use of glasses, wands, or other devices designed to bring the simulated experience of this alternative world into existence.

3. Painting and Photography

Before I ask what conclusions, if any, we might draw from the enlarged frames of reference and technological practices discussed above, I want to say a few words about painting and photography to underline that historical practices continue to be a part of art in our age of science and technology. My rationale for this digression is that we are prone to look at innovative work in our time in ways that often makes it difficult to appreciate and conceptualize that artists have always found ways to exploit technologies and this has — and does — bring vital and exciting possibilities into their studios, or labs — regardless of their medium of choice, at least in my opinion.

As I mentioned earlier, in the 15th century, painters were enthusiastic about the way they could control the optical effect when binding oil and pigment. Similarly, in the late 18th century and throughout the 19th century, painters were able to re-invent painting with the entry of prepared canvases, manufactured brushes, and tubed paint. No longer needing the support of a workshop to prepare materials and no longer needing to carefully plan in advance how much paint might be needed for projects at hand, artists were able to work with greater speed and self-sufficiency. Moreover, as advances in chemistry revolutionized the range of available color options, artists found they had a greater variety of paint to use as they experimented. Photography, while often a part of how painters re-invented art in the 19th and 20th centuries, also offers an excellent counterpoint to this revolution in painting, for this new medium independently contributed to the story of art and technology.

While the fascinating history of photography as an art form in its own right — how the medium was discovered, debated, and popularized — is well beyond the scope of this presentation, I do want to say a few words about the history of photographic experimentation to underscore that the focus on the ease and abundance of image-production that entered with this new medium too often obscures the passion and artistry early people of the camera brought to their investigations.

For example, the clear, crisp daguerreotypes, invented in France in 1839, were produced on silver-plated copper sheets. These images generally had a glittery, reflective surface and are exquisitely detailed. The photogenic drawings, also invented at about this time, were soft images. The drawings were produced when sensitized paper was exposed to light until an image became visible. The images were fixed with water and, when stabilized, lacked the detail of the daguerreotype.

Calotypes, an extension of the photogenic process, were produced when sheets of paper were brushed with salt solution, dried, and then brushed with a silver nitrate solution. After being dried again, the paper was used in the camera. Unlike the daguerreotype, the calotype could be used to produce multiple copies of any image. Still, like the photogenic drawing before it, the calotype contained less detail than the competing daguerreotype.

These are only some of the early variations practitioners used in the basic process of fixing the image. Viewing the variations that were tried in photography's early days, as you can see, reveals many subtle perceptual differences defined the images as artists began to experiment with possibilities (Newhall, 1982; Trachtenberg, 1989). What is key within this is that when the term photography was chosen (in 1855) it simplified the vocabulary, but not the contradictory responses people brought to this then new medium.

For example, Carelton Watkins' artistry is apparent whether we are looking up among the sugar pines in this 1878 photograph or observing a crate of peaches. Julia Margaret Cameron demonstrates a quite different approach. She avoided the perfect resolution and minute detail that glass negatives permitted, opting instead for carefully directed light, soft focus, and long exposures (counted in minutes when others did all they could to reduce exposure to a matter of seconds.) (Daniel, 1999). All of these elements explain why her print of Sir John Herschel, for example, is so striking. We can also find examples of extraordinary work such as an anonymous 1839 engraving of Christ's head superimposed on an oak leaf, another photogenic drawing.

Often photographs were contrived using stereo cameras to register two slightly different images, the two lenses acting like two eyes. Stereo images were sometimes merged in printing or sometimes printed as stereograms — two side-by-side images — that could be converged with the use of a stereoscope. What is important to keep in mind is that the stereoscope fuses the two images and the depth the fusion adds is a function of the slight differences between the left and right sides of the images, as you can see in both of these stereo photographs. If you look at the edges of a paired stereogram image you can identify that each frames a slightly different physical space.

Why have I included stereograms and the stereo camera to this lecture? First of all, this technology is now generally remembered as a popular form of entertainment in the nineteenth century although scientists and artists often collaborated early in the nineteenth century and these collaborations both aided scientific research on binocular vision and fostered enticing artistic experimentation, a fascinating topic I won't pursue today. Secondly, the stereogram was based on scientific work that illuminated how we converge the different images received by each eye. This technology is precisely the technology that is now being incorporated in a more advanced form into the design of the glasses, headsets, and wands now used in the virtual reality environment. In other words, while new technologies and scientific tools inform art, the nature of this exchange is not bound by historical moments nor any particular discipline or approach. Rather, intentions and aspirations continually feed into one another.

With this in mind, the last artist I want to discuss today is the British artist David Hockney. Hockney's curiosity and urge to experiment has been evident throughout his career and this might explain why it has always been difficult to characterize his work. For example, one early and major change in his work came in the 1960s when he visited Los Angeles for the first time and began to paint

with the then new acrylic emulsion paints. This coincided with a shift in emphasis within his work from texture to color, a shift that necessitated a change in his working methods since significantly more preplanning was required when using rapidly drying acrylics rather than oils.

In Hockney's *A Big Splash*, painted in 1967, the vivid colors offer a striking contrast to the flattened perspective. Hockney has said the colors were blocked in first and, to do this, appropriate areas were masked with tape. Indications of the masking are evident if you look closely at areas like the diving board. Yet, the reason this piece is not about a 'stripped painting,' so to speak, is that after the geometry was in place Hockney used delicate brushwork to paint details such as the splash, chair, and foliage. The splash, for example, took about two weeks to paint.

Mr. And Mrs. Clark and Percy, another work executed using acrylic emulsion paint, dates to 1970-71. Much of the planning for this painting involved drawing as well as photographic pre-planning. This painting also illustrates Hockney's urge to continue to experiment with paints per se, for in this work Hockney diluted the acrylic medium with large quantities of water and, in this form, the paint acted like a glaze.

Currently he is still experimenting, often using old technologies with newer tools and vice versa. Briefly, after seeing the recent Jean-Auguste-Dominque Ingres (1780-1867) exhibition — it was in London, New York City, Washington DC — Hockney theorized that Ingres might have used an optical device known as a *camera lucida.* Ingres worked in the late 18th and early 19th centuries and this device was originally patented in 1807, so Hockney's assumption is a plausible one. Hockney believes Ingres used it to quickly secure a likeness when drawing people he did not know.

Now the camera lucida is a particularly interesting tool in the context of this lecture because it was William Henry Fox Talbot's frustration with this instrument that led Fox Talbot to experiment with processes that would chemically fix images — and to successfully invent several of the intial processes used by early 19th century photographers.

The camera lucida, as you can see, is a small prism (mounted at the end of a metal arm) through which the subject is refracted and reconstituted as a virtual image on a sheet of paper. Hockney began using his in 1999 and quickly became convinced that lenses and optical devices of various kinds had been widely used by artists for a good five hundred years to avoid awkwardness in drawing difficult forms. While his controversial ideas have certainly generated much discussion, it is not the question of their validity that I want to grapple with today. Instead I would like to explore some of the accomplished work Hockney has produced through his efforts with this device, such as his portraits of Gregory Evans drawn with and without the camera lucida.

A recent piece created with the camera lucida is *The Twelve Portraits after Ingres in a Uniform Style*. The work consists of twelve portraits of uniformed National Gallery guards, drawn from life in pencil, crayon and gouache. Each was drawn on grey paper, and in a single sitting lasting between three and five hours, with short breaks, so as to capture the intense and lively presence of each person.

After completing the initial drawings with the camera lucida, Hockney began 'playing' with these new drawings using contemporary technologies, as has become his habit. For example, he created photocopied enlargements of details such as the heads, so that he could pin them up and study their

network of marks more closely. Then, using a colour laser printer to capture as effectively as possible their tonal nuances and vivid hues, Hockney found himself improvising a second, much larger, version of the work that consists of the twelve heads – laid out in a single row, but in the same sequence as the original drawings – surmounting the twelve pairs of hands. On the left are seven of the twelve images, and you can compare them with the six on the top and the one on the furthest right below. The resulting fractured images of the second piece exaggerate the imposing physical presence of the figures and call attention to the way that their personality and identity are conveyed as much through their manual gestures as through their physiognomy and facial expression.

Created with the assistance of a photo-mechanical process, these 'copies' bring full circle the dialogue with lenses and optical instruments that lay behind the creation of the original drawings themselves, for which Hockney had availed himself of a camera lucida. They also, in effect, bring the topics I've discussed throughout this lecture full circle.

Conclusion

So let me conclude by stating that today I've attempted to blend experimental work with more traditional forms in order to demonstrate that it is not technology per se that makes the difference, but the kind of focus practitioners bring to their use of the new tools. Within this context, I've also attempted to demonstrate that artists, scientists, and enthusiasts invent the innovative technologies that allow us all to experience and employ new points of view. What is perhaps unique to the story of art, as I have shown, is the number of ways in which artists expand the nature of the technological tools they use as they use them. Not only does this stretch creative boundaries, it also provides a means to effectively present heart-felt communications that speak about personal, cultural, and political concerns. While my focus today has been primarily on technology per se, this is not intended to deny that the forms that new technologies engender go far beyond the technology itself — but I'll leave this 'beyond' for another time.

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