and "Color in History" are appealing and, in some cases, deliver admirably. In others, we get little more than snippets and are left wanting more. There can be no doubt that Gage has read a good share of the literature about color, but too often he assumes that the general reader has already been down the same path and is more interested in his gloss than in a full explanation.

Nonetheless, the book has many items of interest. For instance, one illustration provides an exercise on the phenomenon of color complement wherein the after-image of red is green, as expected, but as Gage remarks in this case it really is a blue-green. According to the author, "since about 1800, red's complement has usually been described simply as 'green'—partly because in the system of the three primaries of red, blue and yellow, the complement of each color was deemed to be an equal mixture of the other two."

Color-circles or color-wheels, extended and modified over the last three centuries, are of considerable application in this context but still cause confusion between physics and art. Isaac Newton (1642–1727) was initially occupied with splitting white light into its component colors, with the aid of a prism, and in describing the resultant linear spectrum. When a beam of light from an incandescent lamp passes through a prism, it emerges as a spectrum, the so-called colors of the rainbow. Newton went on to show that light of a "pure" color could not be further diffracted but, most important, white light could be reconstructed from a mixture. Newton's color-circle (Gage: fig. 58, p. 136) taken from his *Opticks* of 1704 shows the spectral colors as clockwise sectors in the order of red, orange, yellow, green, blue, indigo, violet. The original significance of these discs was that they look white when spun on a top. This was the kind of evidence that led Thomas Young (1773–1829) to his theory that there are three color receptors—red, green and blue—in the retina. James Clerk Maxwell (1831–1879) further developed these ideas and was one of the first to employ a team of observers (including his wife, who suffered from a form of color-blindness).

Somewhere along the way, the color wheel became more of an artistic prop than a physical tool. Thus a modern version has red, yellow, green, cyan, blue and magenta. Magenta (a purplish-red), so-called because it was discovered by the dye industry about the time of the Battle of Magenta (Italy, 1859), is not a spectral color. It is placed in the artistic color wheel, between blue and red, for symmetry and is deemed to be the complement of green, as yellow is to blue, and red is to cyan (compare with bluish-green mentioned above). More attention to these historical aspects might have helped Gage in his attempt to bridge the divide between science and the arts.

J.M.W. Turner (1775–1851) and Georges Seurat (1859–1891), both heavy-hitters in the world of color, receive new treatments. Gage enjoins us to worry along with him as he asks, "What were these artists really up to!" In each case, the author ends with unfair suggestions that they were "pretending" to be more knowledgeable about color theory than is revealed in their products. Gage seems to be greatly bothered by Turner's local (unnatural) color and with Seurat's mixing dots and dashes of color in the same picture. All of this reminds me of the time a local artist, who favors constructivism, described the mathematical progression that was the basis of one of his works. A viewer pointed out a seemingly abrupt departure about half-way up the sculpture. The artist smiled and declared that it was an error, but the whole thing looked better for it.

Gage's format requires some orientation for the reader. Each artistic reproduction or line drawing is accompanied by a caption that ends with a number in boldface, enclosed in parentheses. These turn out to be figure numbers but are never described as such, and are referenced only by plain numbers floating in the margins of the text. They are not to be confused with literature references and notes, which appear as small superscript numbers in the text and are grouped in the back of the book by chapter. After searching in vain for a number of key items, I lost confidence in the index. In the age of the word-processor, the construction of a comprehensive, richly cross-referenced and intentionally redundant index is hardly the daunting task it was for the card-shuffling specialist of yesteryear.

I was disappointed that Edwin Land's hypothesis, that the key to color vision is the comparison of information of longer versus shorter wavelengths about a "fulcrum" of yellow, does not rate a mention in Gage's work. Because of the occasional gap and failure to develop within the "science" subtitle, this book is unlikely to find a large audience as a primary source. It will find the happiest home among graduate-level courses in which further essays and lecture materials complement the present text. One supposes that the book is used as such in the United Kingdom, where Gage was formerly Head of the Department of History of Art and is currently Reader in the History of Western Art at Cambridge University.

THE ROBOT IN THE GARDEN: TELEROBOTICS AND TELEPISTEMOLOGY IN THE AGE OF THE INTERNET

edited by Ken Goldberg. MIT Press: Cambridge, MA, U.S.A., 2000. ISBN: 0-262-04176-6.

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*(Editor's Note: For another review of this book, by Eugene Thacker, see Leonardo **34**, No. 2, 2001.)*

Evidently, a large number of publications in media philosophy, cognitive science and engineering explore how new technologies not only challenge modes of communication but also question commonly accepted assumptions concerning the understanding of perception and knowledge. A variety of interdisciplinary approaches converge in both the humanities and computer science to examine the effects that remotely controlled machines (telerobots) and information presented on the Internet (through webcameras and more complex tools for "telepresence") have on the human understanding of time and space, of nearness and distance, of reality and fiction. Most of the recent debate raises new conceptual considerations of "older" disciplines and sheds light on major shifts in the philosophical discourse of epistemology that are seen in the context of emerging technologies: mechanical, electrical and microprocessing.

The examination of epistemological issues in *The Robot in the Garden,* edited by artist-engineer Ken Goldberg, extends this trajectory and deals with the phenomena of telepresence and remotely controlled interaction with and through media that are seen as a determining cultural form in the age of teletechnologies. As Goldberg suggests in

the introduction, tele-technologies such as telephone, telegraph and television are by definition mediators and communicators of *information* at a distance, whereas the telerobot allows one to control and manipulate *action* at a distance. It is significant that the global dimension of telepresence (the term was introduced by Marvin Minsky) in the Internet is performed by webcameras. Goldberg (himself a pioneer in the development of robots controlled through the Internet) and cultural critic Thomas J. Campanella convincingly argue that the experience of telepresence on the Internet forms a new paradigm of surveillance and immersion, especially when webprojects use webcameras in combination with telerobotics as a technological means to achieve a high "reality effect."

The widely discussed project *Telegarden* (a telerobotic Internet installation by Goldberg and others) asks users to directly plant and water seeds in a real but remote physical space. Since the real garden is accessible only over the Internet, Machiko Kusahara concludes, in her discussion of reality effects achieved through webcameras and robots, that "our knowledge of the Telegarden is technologically mediated, and that introduces a disturbing doubt." Ultimately, there is no evidence that would allow us to know that the Telegarden really exists. Blake Hannaford provides a different explanation of determinations and explains, from an engineering perspective, the need to develop telerobotics and remote manipulation. Hannaford unfolds, in a comprehensive way, the ideas and limitations of telerobotic systems that have been designed to master action at a distance and "bi-directional" communication.

Taking an historical view of the philosophical considerations of mediation (following Descartes, Locke and Sartre), the resulting epistemological question centrally deals with the subcategory "telepistemology." Goldberg introduces this to describe the experience of a second degree of "mediation" that conceptually means forgery, skeptically implying the loss of proof of what is real. However, a different standpoint in psychology is represented in the reprint of Maurice Merleau-Ponty's famous essay, "Film and the New Psychology," from 1945. Merleau-Ponty not only rejects the dichotomy of mind and body that underlies the Cartesian assumption, but furthermore argues that

perception is immediate and results from a system of configurations. The point is that perception is not a sum of sensations, but unique "as a whole and at once." This notion in phenomenology shares fundamental assumptions with "gestalt" theory, and has been further developed in cognitive perception theory, which affirms the wholeness of perception in James Gibson's statement of "direct perception."

Hubert Dreyfus, in his brilliant essay "Telepistemology: Descarte's Last Stand," links these two controversial considerations on knowledge. With great lucidity, Dreyfus argues that tele-technologies strongly suggest a reaffirmation of Descartes' skepticism (the more that prostheses are in use, then the more are our doubts reasonable) while at the same time explaining, in accordance with Heidegger and Merleau-Ponty, that our basic relation to the world is direct and not, as skepticism suggests, indirect. The crucial point that Dreyfus makes is that the unquestionable belief in the perceptual world gives the necessary background "that we can doubt the veracity of any specific perceptual experience" so that there is a "background disposition" to confirm reliability and this forms a central issue at stake in tele-technological "reality." Dreyfus's theoretical assumptions evidently coincide with contemporary cognitive psychology, although the parallel to internal schemata is not drawn in the text.

Alvin Goldman, with a background in cognitive science, proposes a "reliabilist approach" to telerobotic knowledge and pleads for a stronger consideration of causal factors of knowledge. Starting from the assumption that a set of conditions/beliefs constitutes knowledge, Goldman approaches the telepistemological problem posed by *Telegarden* in contextual terms in order to specify the characteristics of knowledge that these telepistemological settings may provide. Although the idea of "direct perception" is not explicitly discussed in *The Robot in the Garden,* it is nevertheless conceptually addressed where the phenomenological approach, such as Goldman's, shares common assumptions with ecological cognitivism. In claiming that the perceptual act is guided by selection and internal schemata, an ecological approach to knowing how we perceive things in motion in three-dimensional space would depart from former cognitive psychology and computational theory and reject

the notion of construction, representation and mediation. Moreover, recent research in cognitive science, especially neurophysiology and cognitive film theory, seems to emphasize an ecological notion of perception based on the human capacity for "direct perception."

In the context of a larger debate, the issues discussed in this book parallel the highly contentious topic in cognitive psychology that deals with fundamental assumptions in the act of perception that determine humans' capacities to make meaning of the physical world. Research in cognitive psychology provides evidence for built-in schemata in the human perceptual system, while computational theory asserts that these built-in structures create perception, both veridical and non-veridical (the latter is true in illusion); most authors in *Robot in the Garden* focus, rather, on the realm of philosophy and the dichotomy of mediated versus immediate experience. For example, Catherine Wilson takes up the topic of veridicality within the context of proximity and mediation. Wilson's argument that ordinary experience relates to the notion of proximity whereas telerobotics is mediated experience does, for the most part, coincide with assumptions of cognitive perception theory that perception is direct (e.g. James Gibson, David Marr, Ulric Neisser). However, the second part of the argument refers to the historical philosophical discourse on mediated knowledge that starts with René Descartes and expands the notion of the duality of mediated versus immediate perception into the present.

The debate of mediated versus immediate knowledge holds a prominent position in most of the contributions. The book explicitly raises questions about mediation of experience, knowledge and perception in relation to tele-technologies in ways that deliberately refer to the conception of knowledge as it stems from the history of skepticism, raising doubts about the reliability of the "instruments" of perception. The collection of essays mainly confirms the Cartesian aspect of mediation inherent to perception, because it was with the advent of Cartesian doubt that the notion of mediated perception became attributed to knowledge. Again, it is Dreyfus who traverses the body-mind separation in the history of discourse and points out that what is lacking in telepresence is clearly defined by Merleau-Ponty's term "intercorporeality," which describes a

more basic element than actual experience. It is "our sense of being in the presence of other people."

Dreyfus also agrees with Albert Borgmann's phenomenological assumptions, also in the book, that ordinary perception is qualified by "inexhaustible richness of reality repleteness," so that "the presentation of reality in cyberspace is shallow and discontinuous." Borgmann's approach on "nearness and distance" clearly differs from Wilson's dual concept of real and fictional and discusses shifts in the parameter of time and space that result from technology's cancellation of the dimensionality of time and space. Borgmann examines proximity in terms of continuity and density and concludes that the "brittleness" of cyberspace expresses its lack of "metric." Not only is telepresence at best a "poor imitation" of direct perception, as Dreyfus states, but according to Borgmann, it also lacks dimensionality. It is interesting to note here that "repleteness," the key term in Borgmann's and Dreyfus' argument that describes the richness lacking in "tele-technologies," is also discussed in another timely debate on media elements, in particular, Gilles Deleuze's and Edmond Couchot's argument that spatial and temporal features, namely directionality and dimensionality, are fundamentally lacking in new technologies. Although Martin Jay, an expert on "new French philosophy" does not explicitly refer to this debate, he does explore changes in the temporal-spatial setting of perception processes. Jay correlates insights from the history of optics to the contemporary debate on reality and simulation and gives a critical reading of Jonathan Crary's stress on "disembodied vision" (based on the camera obscura). He concludes that the unavoidable gap between "appearance and essence, subjective experience and objective stimulus" always results in a "delay in time." The point being made is that the discovery of the speed of light in the seventeenth century by Ole Roemer identifies a delay so that we do not see what is, but what "is no longer." Furthermore, there is evidence of "indexical traces of reality" that, according to Jay, are not dissolved in virtual reality and telerobotic technologies. The major claim in Jay's argument is that "telerobotics resists reduction to an apparatus of pure simulacral construction." Significantly, Jay affirms the idea of "mediated perception of a distant reality;" however, the decisive factor that "appearance through technological media-

tion is the only reality we can know" rather confirms the notion of "one world."

While Dreyfus's critique of skepticism adds that remote-control also means that one is able to avoid risk, Marina Grzinic offers a political-military context for the understanding of the specific clean "look" of new technological images. Grzinic develops the argument that "telerobotic time-delay," which occurs in the transmission of live images, unveils the "aura" of the image that, according to Walter Benjamin, gets lost in technical perfection. Grzinic makes the point that technological imperfections in time delay provide evidence of the real world, whereas the cleaned-up images that result from a "process of sterilization" imply a process of veiled "information about the 'dirty' and very real war in Bosnia and Herzegovina." This issue of reliability forms a major concern throughout the book, which brings together different views from philosophy, the history and theory of arts, and applied sciences. In multifaceted ways, these views try to analyze how new technologies foster belief in "direct" communication, albeit through the use of "remote" tele-manipulation. Since the majority of the essays collected in the book take the key duality as an unquestioned assumption, the focus is mainly to develop further criticism and sub-categories without really questioning the epistemological setting. Nonetheless, it is worth emphasizing that there are interesting ways to connect telepistemology to applied cognitive science, and that these are opening other avenues of approach.

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EXHIBITION CATALOG

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TAKAHIKO IIMURA—FILM ET VIDÉO

by Daniel Charles. Galerie nationale du Jeu de Paume, Paris, France, 1999. 126 pp., illus. Paper. ISBN: 901181-70-1. In French and Japanese.

Reviewed by Fred Andersson, Ulvsbygatan 29 (6), 654 64 Karlstad, Sweden. E-mail: <konstfred@hotmail.com>.

Is there such a thing as a conceptualist filmmaker? Is not conceptualism in a sense contradictory to filmmaking? The

feeling of immersion and narrative in the filmic experience—is this necessarily the opposite of an intellectual, conceptual standpoint? Takahiko (Taka) Iimura is a Japanese filmmaker and video artist who, since the beginning of the 1960s, has moved toward the experimental peripheries of the media of moving images—peripheries in which the popular sphere of filmmaking gradually transforms into the conceptual and minimal.

The present catalog, *Film et vidéo,* was made in conjunction with Iimura's retrospective at the Galerie national de Jeu de Paume in Paris, 11–30 May 1999. With only black-and-white illustrations, which is perfectly fitting for a production so dominated by black-and-white, this catalog (with parallel texts in French and Japanese) covers and explains Iimura's development, from early 16-mm films such as "Ai" ("Love," 1962; music by Yoko Ono) to the final presentation of his impressive CD-ROM *Observer/Observed and Other Works of Video Semiology,* produced at the Banff Center in 1998–1999. However, the major part of the catalog consists of Iimura's own text on video semiology, taken (with illustrations) from the CD-ROM.

The catalog describes three series of minimal video sequences: "Camera, Monitor, Frame" (five sequences, 1976–1998), "Observer/Observed" (three sequences, 1975–1998) and "Observer/Observed/Observer" (three sequences, 1976–1998). According to Iimura, these videos are semiology—art as theory rather than theory of art. In a very matter-of-fact way, they explore the spatial structure of the video medium and the relations between camera, monitor, observer and observed. There is nothing to be seen here, except cameras, monitors, written or spoken statements like "this is a monitor" and, of course, also the observers (who sometimes become the observed objects of their own observation).

Referring to formalist film theories such as those of Sergei Eisenstein and Dziga Vertov, Iimura looks for a relation between "the logical structure of the video system" and the grammar of spoken language. But his aim is also to stage a rupture *(une saut)* between word and image. For example, a camera first films the text "this is a monitor" and then turns to a monitor connected to the camera itself, which creates a short circuit (monitor within monitor within monitor). Contrary to the written statement, there is really no monitor—just images of monitors within images of