Visual Systems Analysis

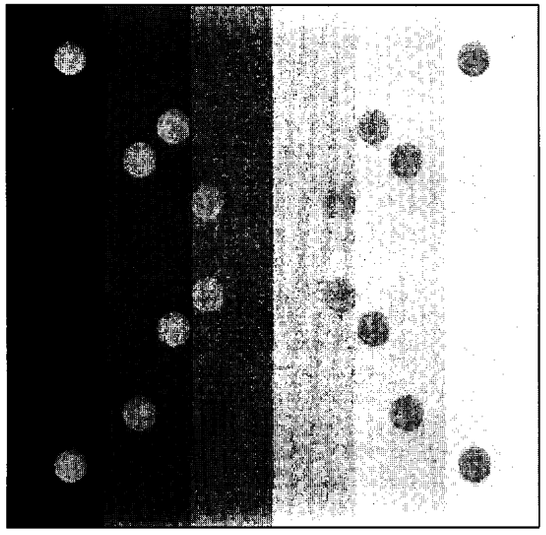
Contrast Sensitivity. ROBERT SHAPLEY and DOMINIC MAN-KIT LAM, Eds. MIT Press, Cambridge, MA, 1993. xx, 342 pp., illus. $85 or £76.50. Proceedings of the Retinal Research Foundation Symposia, vol. 5. From a symposium, The Woodlands, TX, March 1992.

At the beginning of the 17th century René Descartes proposed the first plausible neural theory of vision and visual perception and thus began a scientific enterprise that has continued unabated to the present day. The characteristics of this endeavor were already firmly established by the end of the 19th century: the study of perception, especially visual and auditory perception, was a mixture of the study of philosophy, physics, physiology, and psychology. This blend is reflected, for example, in Fechner's coining of the term "psychophysics" in 1860, in Bain's establishment of the journal *Mind* in 1876, and in the founding of the German-language journal *Zeitschrift für Psychologie und Physiologie der Sinnesorgane* by Ebbinghaus and König in 1890.

Scholars working to understand vision and visual perception have kept close to the Cartesian goal of figuring out "how it works" by investigating both the psychology and the physiology of perception. Most successful psychological theories of vision are formulated to be physiologically plausible. There are numerous instances in the past 100 years in which psychological theories preceded the discovery of the physiological substrate. The existence, for example, of three types of cone receptors in human vision was established from psychophysical experiments well before their anatomical reality was revealed. The history of vision research has been a process of continual improvement of our understanding of how the physical world comes to be represented in our mind by our brain.

Contrast Sensitivity would have astonished and delighted Descartes, Fechner, and Ebbinghaus, for it reveals the tremendous progress we have made in understanding the psychophysical and physiological processes that contribute to visual perception. The book concentrates on one of the most important of visual functions: the extraction of contrast information from the environment. The editors, who provide introductory commentaries on the individual contributions, have done a masterly job of organizing the material into a logical framework. The book is divided into four parts: Retinal Processing of Visual Signals, Retinal Ganglion Cells, Central Visual Pathways, and Human Contrast Sensitivity and Its Clinical Applications.

The individual chapters themselves are uneven in quality. One or two of them are poorly organized and written in such a manner that only an expert in the topic under discussion would understand them. These are counterbalanced by many others that are brilliant examples of clear expository writing, providing historical background material, a general rationale for the methods employed, and a succinct summary of the findings as well as insights into how these findings fit into a larger picture. Shapley's excellent introduction gives a comprehensive summary of the book. The contribution by Rodieck, Brening, and Watanabe on the origin of parallel visual pathways will delight the reader with its detailed comparison of the cat and monkey visual systems.



"Sixteen equiluminant circles on a luminance staircase. This pattern was created on a CRT display with a computer-controlled instrument. Each rectangular area in the staircase is of a fixed uniform luminance. The luminance of the circles—all of which have the same luminance—is the same as the mean luminance of the staircase." [From *Contrast Sensitivity*]

In a marvelous paper on retinal ganglion cells Enroth-Cugell traces in fascinating detail the historical development of sensory neurophysiology, putting the work of many researchers, including her own, in proper historical perspective. The chapter makes it clear why Enroth-Cugell deserved her 1992 Helmerich Award for outstanding contributions to visual science.

The book is not entirely successful in developing a picture of the precise relationship between physiological activity and perceptual experience—which is not surprising, given the difficulty of the enterprise. Nonetheless, I strongly recommend it to all scientists who want to deepen their understanding of the functioning of the visual system. The vision specialist, regardless of background, will learn much from it.

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A Trans-Specific Agenda

The Great Ape Project. Equality Beyond Humanity. PAOLA CAVALIERI and PETER SINGER, Eds. Fourth Estate, London, 1993, and St. Martin's, New York, 1994. viii, 312 pp., illus. £9.99 or $21.95.

Should we conserve the great apes and their remnant habitats? Of course!

Should we eschew extreme notions of human transcendence over biology and try to learn as much as we can about the human career and condition by observing the behavior of captives and natural populations of apes? Most certainly!

Should we stop the dyseducational use of apes as Calibans in drag by entertainers and advertisers? Absolutely!

Should we eliminate their employment as subjects in medical and basic biological research involving painful invasive and highly restrictive procedures? Probably in most, perhaps all, cases.

Must we view ourselves as great apes or accept them as humans in order to accomplish these goals? Probably not.

I had reached these conclusions over the past decade before encountering *The Great Ape Project*, a collection of short essays that severally address these issues.

The volume opens with a "Declaration on Great Apes," which demands expansion of the community of equals to include not only all people—as great apes—but also chimpanzees, bonobos, gorillas, and orangutans. Accordingly, (i) no member of the community may kill another, except in self-defense or similar extremity; (ii) no member should be imprisoned without due legal process, and current captives should be released; and (iii) no great ape should be subjected to severe pain, either wantonly or for an alleged benefit to others.

This declaration is supported by 36 authors in 30 chapters and an editorial epilogue. The authors are almost evenly divid-

ed among Europeans and North Americans, with only one Asian (Nishida) and no African or South American. They represent a range of humanistic, natural historical, and social scientific disciplines and perspectives, but there is no voice from the biomedical community. Language studies with great apes weigh heavily in the arguments of several authors for their having highly developed intellectual abilities, sensibility, and personalities.

It may be imprudent for sponsors of the Great Ape Project to premise their case on current genetic information, as some authors in this volume (Goodall, Fouts and Fouts, Miles, Patterson and Gordon, Diamond, Dunbar, Ryder) do to varying degrees. Although chimpanzees and humans may express approximately 98.4% genetic (DNA) similarity overall, this still leaves many individual genes that differ. We do not know the functional meaning of the genetic data. Tagging humans as "great apes" will cause a semantic muddle—like the argument from genetics, it is, at best, marginal to the case for improved treatment of our nearest relatives. Instead, their sensibility, intellectual abilities, and personalities must carry the day.

Despite frequent mention of the genetic closeness of humans, chimpanzees, bonobos, and gorillas, the topic of possible hybridization between people and African apes is merely mentioned (Clark, Ryder) in *The Great Ape Project*. Bonobos and chimpanzees, which have the same number of chromosomes ($2n = 48$), can produce hybrids, and siabons have been produced via interbreeding siamang ($2n = 50$) and lar gibbons ($2n = 44$). We cannot deny the possibility that humans ($2n = 46$) and chimpanzees could birth hupanzees. Of course, such radical experiments should be unnecessary to establish universal humane treatment of apes.

The Great Ape Project surely would stimulate discussion in classes on conservation, ethics, morality, law, personality, and human nature. It should be read by all practicing and would-be primatologists and laboratory technicians, particularly those who work with captives. My unranked top ten picks among the variable chapters are those by Goodall, Miles, Bekoff, Corbey, McGinn, Rollin, Mitchell, Francione, Noske, and Sapontzis.

One would be foolhardy to predict the impact of the book on public policy. The best hope of subscribers to the Great Ape Project is to expand lobbies that protect the lives and dignity of these magnificent creatures and to extend the mandate to embrace all beasts that evidence personalities. Like people, they can return great joy to those who love them and attempt to understand them on their own terms. The bottom branch is that policy-makers must bend to a largely emotional appeal that deeply prods our moral, spiritual being—the essence of humanity.

I am skeptical that *The Great Ape Project* holds the answer but am at a loss to suggest viable options. The enlistment of analogies to injustices that men visit upon slaves (usually people of color), intellectually impaired persons, women, children, and gender extenders is unsettling in ways that would deter me from supporting the declaration on great apes were I not already intimately acquainted with them. Such comparisons neither promote the equal dignity of all humans nor lead to a full appreciation of the adaptive complexes and novel capabilities of apes. Though none of the science fiction (Regan, Miller) in *The Great Ape Project* is as compelling as Boulle's *La planète des singes*, some of its anecdotes (Rollin, Cantor, Swart) are gripping.

Now we need published precise plans on the nature of the proposed "special territories in our countries" (p. 6) that are to accommodate liberated captives and how they are to be governed and supported financially. Second, it is imperative that the biomedical community inform debate by setting forth an inventory of specific remedies that have resulted from recent use of great apes as humanoid models and test subjects. They also should provide detailed accounts of why other means—tissue culture, genetic manipulation, computer models, observations on human patients and naturally afflicted nonhuman subjects—cannot serve instead during quests for treatments and cures. Third, all nations that have indigenous populations of apes should respond vigorously to the international call for their conservation via hands-off approaches to their habitats and bodies. Finally, we should work and, for those so inclined, pray for peace and good will toward all animals and their ecosystems.

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Vignettes: Research Accoutrements

There is no going back to the more primitive arrangements of 30 or 40 years ago. Only a scientist who is already of Nobel Prize class can now get away with blowing his own glassware, preparing his own standard reagents, answering his letters (belatedly!) in longhand and composing his papers on a portable typewriter at a tiny desk in an odd corner of a crowded laboratory.

—*John Ziman*, in *Prometheus Bound: Science in a Dynamic 'Steady State'* (Cambridge University Press)

When I see a beautifully computer-prepared, full-color slide, what first goes through my mind is "this guy obviously doesn't have enough to do."

—*Peter J. Feibelman*, in *A Ph.D. Is Not Enough! A Guide to Survival in Science* (Addison-Wesley)

Mechanisms of Control

Translational Regulation of Gene Expression 2. JOSEPH ILAN, Ed. Plenum, New York, 1993. xxiv, 493 pp., illus. $95.

Messenger RNA and translational regulation have come a long way since the early 1960s, when mRNA was thought of as a short-lived intermediate and control mechanisms were thought to be centered on transcription. In the late '70s Charles Yanofsky and his colleagues demonstrated that, besides transcriptional regulation by repression, the genes of the *trp* operon of *Escherichia coli* are subject to translational regulation by transcription termination, known as attenuation. This mechanism has been shown to be a common regulatory control in bacteria as well as in eukaryotic cells and their viruses.

Translational regulation of gene expression has been increasingly recognized as an important control in cell growth and development. Protein synthesis is a significant metabolic process in the cell and one of the major consumers of energy; its products (enzymes, growth factors, stress proteins, and so on) must be carefully regulated. Translational regulation proceeds through an enormous diversity of mechanisms, many of which are detailed in this timely book, which is an