one objection to the early diffusionist theorists — it was, apparently, possible to sail one of these frail craft across the oceans. But by this time, other forms of evidence were readily available which demonstrated that Oceania, for instance, had without question been colonized from Indonesia, and that the remote Pacific islands like Easter Island had been colonized from central Polynesia. Food crops and perhaps other culture items may have been borrowed from the Americas, but there was never any significant population movement from America to the Pacific until modern times. Nor was there a single source of high culture in the world. Moreover, cultural change was no longer solely or even primarily attributed to migrations. In many parts of the world it was clear that changes followed a local course, and that (contrary to the speculations of the evolutionists) these could take divergent routes, as, indeed, a true darwinian would have anticipated.

But Heyerdahl's missives are not addressed to the anthropologists, and his fundamental message is not really about ancient Egypt or Peru. The message is a myth. All human culture is one in origin, all men are brothers, nature is pure but it must be mastered, and it can be, with courage and using the tools of ancient civilization. This is a message which can be traced, by any good, amateur diffusionist, to the cultivated, puritanical, provincial world of pre-war Norway, from where it has been carried across Europe, and indeed across the world, by a race of fair-haired ecologists, development experts, missionaries and, of course, Thor Heyerdahl himself. The BBC should have broadcast this series in its religious slot. □

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From East and West

John E. Midwinter

Optical Computing. Edited by B. S. Wherrett and F. A. P. Tooley. *SUSSP Publications, Edinburgh University Physics Department: 1989. Pp. 314. Distributed by the Institute of Physics, £45.*

Optical Processing and Computing. Edited by H. H. Arsenault, T. Szoplik and B. Macukow. *Academic: 1989. Pp. 493. £42.50, $59.50.*

HERE are two hard-cover volumes on the general topic of optical computing. The first, by Wherrett and Tooley, stems from a NATO Advanced Study Institute held in 1988. The second, by Arsenault *et al.*, is a conventional edited volume in which each chapter is written by a different author. However, and perhaps of particular interest to Western readers, about half of these are from Soviet authors.

Both books start with chapters by Goodman of Stanford University. In *Optical Computing*, Goodman's historical essay provides an admirable basis against which to view both books. Goodman traces the thinking of optical computing from the early theories on the resolution, imaging properties and coherence of optical systems of Abbe and the recognition that the near- to far-field power distributions are intimately related to the Fourier transform and to Zernike's work in the study of phase objects, such as in the phase-contrast microscope.

This was followed during the late 1950s and early 1960s by work on coherent analogue processors which explicitly exploited the Fourier-transform relation to implement the functions of frequency filtering, correlation, convolution and so on. In most of these early processors, the 'data' had to be fed into the optical system using a photographic film, representing a major engineering problem for real-time processing systems. Because the main application of the technique was radar processing, this problem was very serious. From those early days, one can trace the attempts to use acousto-optic modulators and spatial light modulators as data-input devices to overcome these problems, yet despite advances in optical technology, it seems that 'silicon' has always managed to stay ahead.

One obvious problem with all analogue signal processing is the need to handle large dynamic range signals, something that is particularly difficult in optical systems. Hence attention has increasingly shifted to digital-processing schemes using optics as a possible solution. Of course, this brings the optical processor closer still to its electronic digital equivalent and again invites a comparison which is usually not very favourable. Undoubtedly the biggest problem facing all optical computing proposals is the astonishing success of electronic approaches. Hence it is perhaps disappointing to see that the contributors in neither book make a serious attempt to relate what optics can or might do to what electronics already does — although of the two, *Optical Computing* is superior in that it includes one chapter dealing with the technology trends for VLSI circuits and another discussing current developments in electronic parallel processing.

For a reasonably well-balanced overview of the current topics in optical computing, my choice is the volume edited by Wherrett and Tooley. The selection of speakers at the original meeting was good, giving balanced representation to the many strands of activity that fall within this broad field. There are good reviews on both the analogue and digital aspects, on many of the key devices currently being studied and on the system and architectural issues that are attracting debate.

The book edited by Arsenault *et al.* seems less well balanced. A very practical introductory chapter on optical interconnects is followed by a series of contributions (15 in all) in which the emphasis is fairly heavily on analogue processing, a field which has been 'around' for at least 30 years but which seems to have delivered rather little. Accordingly, I was left with the strong impression that there is little that can be described as "up to the minute" in the book although it does share with *Optical Computing* the obligatory (!) chapter on neural networks from the outstanding group at Caltech led by Psaltis. Of the Soviet work featured, only the chapter describing studies of biopolymers (bacteriorhodopsin) was new to me, although I would not claim to be fully *au fait* with every detail of Soviet research.

In summary, then, it seems clear that for a balanced assessment of optical computing today, one would be well advised to read Wherrett and Tooley's book. The book by Arsenault *et al.* supplements this in some respects, for example in a detailed review of photo-refactive materials by Tanguay, but is probably going to be of prime interest for the view it presents of work in the Soviet Union that has not been well reported at conferences. What neither will do with ease is explain to the reader how or when optical technology is likely to impinge seriously on the established might of electronics. □

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