in a foreword to Fritzsch's book that the public has paid the bill for this research.

So what goes wrong? You need an irreducible minimum of terminology to identify the most important particles and the cardinal phenomena; every superfluous technical word beyond that will cost you a hundred readers. It is also a matter of page-by-page comprehensibility. When specialists write for the general reader, they all too often assume that something explained on page 10 can be referred to freely again on page 110. These books require the reader to have almost total recall of unfamiliar concepts.

Then the weird processes of the subatomic world have to be explained as limpidly as possible, to make it clear, for example, that force-carrying particles are matter-antimatter combinations of the kinds of durable particles on which they act. Instead of any such illumination, the reader of the two books under review finds more than he is ever likely to want to know about the decay of orthopositronium or the hyperfine splitting of quark clusters.

Finally, you must jolly the reader along — strew his path with flowers, as Faraday put it. The human adventure of high-energy physics, with its heroic experiments and its races for one Nobel prize after another, provides a ready source of jollification. Frequent reminders that abstruse-seeming processes tell us why the universe is the way it is, and why familiar objects in it behave as they do, can also help. Close works harder at trying to meet this requirement than Fritzsch does.

There ought to be a society for the prevention of mental cruelty to the general reader. (We are all general readers, outside our own areas of expertise.) It took me years to discover that relativity, for example, is quite simple, despite the many "popular" accounts that make it baffling. Readers are too often left feeling stupid but they don't complain because they have no wish to parade what they take to be their own deficiencies, rather than the authors' and publishers'. I doubt whether the publishers of these two books on particle physics, who proclaim their clarity and simplicity, could give any satisfactory explanation of what the books are about. □

Nigel Calder is a science writer. His most recent book on fundamental physics was Einstein's Universe *(BBC Publications, 1979).*

• We received a third book on elementary particles for the layman after Nigel Calder's review (above) was complete: *The Quest for Quarks* by Brian McCusker (Cambridge University Press; £7.95, $14.95). Unfortunately, it would appear to fall into the same errors Calder criticizes — but it is relieved by the fact that McCusker (of the University of Sydney) believes he and others have discovered free quarks. Most physicists would reject the claim, but McCusker argues it well in a 32-page chapter. This raises the book above the usual run, and would make it worth reading, say, for half-an-hour in the library. **Robert Walgate**

Art of electronics

W. Graham Richards

Computer Images: State of the Art.
By Joseph Deken.
Thames & Hudson/Stewart, Tabori & Chang, New York: 1983. Pp.200. Hbk £15, $25; pbk £9.95, $16.95.

CLASSICAL painting never recovered from the invention of photography. The fact that a near perfect reproduction of reality can be made has had profound influence on the artist. Now the development of computer image processing has expanded our vision far beyond the range of human senses and is likely to have an even more drastic impact on artists, photographers and film-makers.

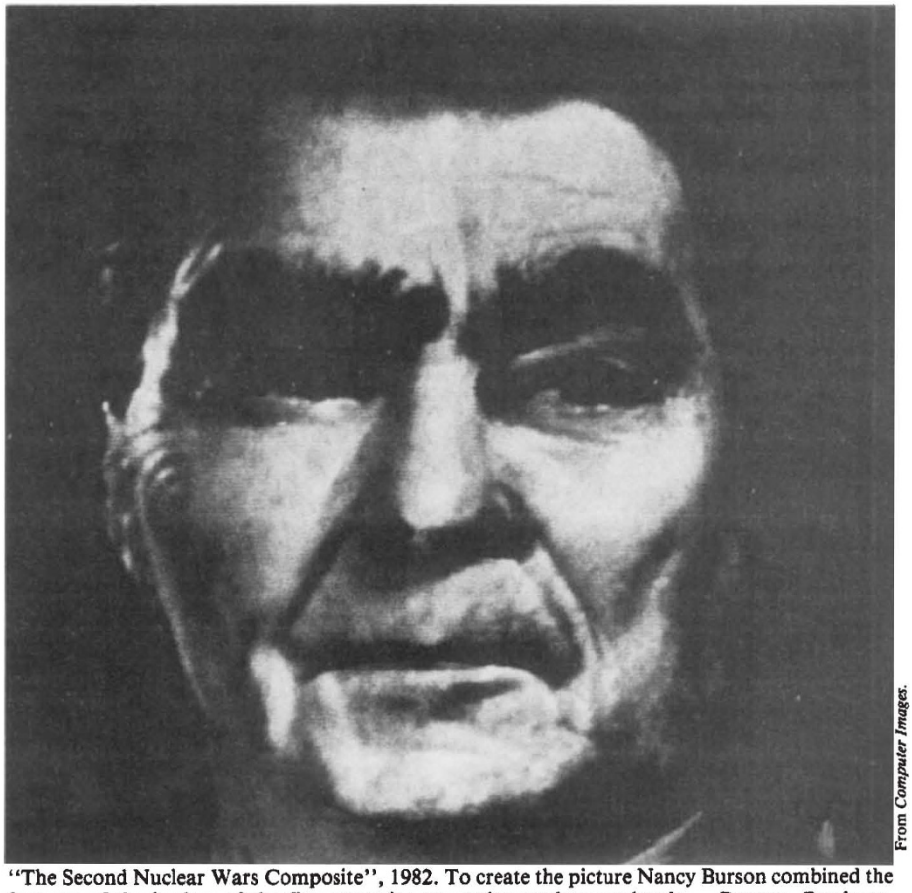
Images can be created with which the observer may interact directly. Already it is possible for trainee pilots to "fly" in totally realistic simulated aircraft and for video games to permit battles such as those in the Disney movie *Tron*. The scope seems endless, and many of the contemporary results are quite lovely to behold.

Deken has given an accurate title to his presentation of the state of the art. In no way a technical book, rather it is a collection of some of the finest current examples of computer generated pictures from a wide spectrum of sources and disciplines. It does serve a scientific as well as a visual appetite. Browsing through the 250-odd highly coloured reproductions gives a clear idea of just what is possible with available technology. Any specialist is likely to encounter some of the pictures from his own publicity calendar, but also to have his imagination stimulated with thoughts of extra things one could achieve with the appropriate facilities.

The author suggests that the combination of computer and graphics display may enhance our vision of the universe in as dramatic a way as the telescope and the microscope. Certainly to anyone working in science at a molecular level this must be true. At last the sterile language of molecular formulae on the printed page can be translated into something which, even if not "reality", is nonetheless a very acceptable and comprehensible metaphor.

The format of a book can, of course, only hint at the extra dimensions available when the images can be made both dynamic and interactive. Despite this necessary limitation, however, the illustrations and accompanying text are sufficient to stimulate both seasoned scientists and graduate students whose careers are likely to be deeply influenced by colour graphics. □

W. Graham Richards is a Lecturer in Physical Chemistry, Oxford University, and a member of the editorial board of the Journal of Molecular Graphics.



From *Computer Images*.

"The Second Nuclear Wars Composite", 1982. To create the picture Nancy Burson combined the features of the leaders of the five countries possessing nuclear warheads — Reagan, Brezhnev, Mitterand, Thatcher and Xiaoping. The extent to which each face appears is proportional to the number of warheads in that country.