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Advanced Graphics with the Sinclair ZX Spectrum

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Preface

With the rapid advance of computer technology has come a substantial reduction in the price of computer hardware. In the coming years the price of peripheral devices will also tumble. This means that users with a limited budget, who previously had access only to the most elementary computing devices, will soon be able to afford the most sophisticated computers. They will also be able to escape from the limitation of tabular numerical output and buy microprocessor attachments for television monitors or inexpensive special-purpose colour graphics devices. Sinclair computers have always led the field in this respect. Software, however, does not appear to be getting cheaper.

Because of the enormous capital expenditure required to set up graphical output in the past, both in machines and software, the subject of computer graphics has been the preserve of large research groups. This inaccessibility has led to a mystique growing up around the subject and it has achieved a false reputation for difficulty. This book is an attempt to lay the ghost of complexity; it will also show that complicated (and hence expensive) software packages, which are naturally of great value in research organisations, need not frighten away the average computer user. For most purposes these packages are unnecessary. This book, as well as being an introduction to computer graphics, may be considered a (very inexpensive) software package: it is a lot cheaper than commercially available packages! Naturally, because of this fundamental approach, users have to achieve a reasonable understanding of their graphics device before pictures, other than those provided, may be drawn. This need not be a disadvantage; the amount of groundwork required will be seen to be very limited. As a direct result, the knowledge of the user grows along with the package and he is far less likely to misinterpret any of the graphical routines. References are given and relevant further reading material is recommended in order to expand the reader's horizons in the subject.

It is assumed that the reader has an elementary knowledge of Cartesian coordinate geometry (the authors recommend the books detailed in Cohn (1961, Coxeter (1974), and McCrae (1953) – see References), and also of the BASIC programming language (see the Spectrum BASIC Handbook (Vickers (1982) and Hurley (1982))). Many interesting programming exercises are proposed, and these should raise the standard of the reader's BASIC expertise. BASIC is a universally popular language, available (in various guises) on all types of micro-computer, so the programs may be easily adjusted to run on machines other

than the Spectrum: it is also a good medium for transmitting the algorithms used in computer graphics, enabling readers to translate these ideas readily into any other computer language of their choice.

The concepts necessary for the study of computer graphics are organised as a combination of theory and worked examples; these are introduced as and when needed in the natural progression of the subject. Some program listings form part of the examples and these should not be considered just as algorithms that describe solutions to fundamental graphical problems, but also as a computer graphics software package in BASIC, or simply as programs to draw patterns. Alongside the examples are a series of exercises that expand these ideas. The practical problems implicit in programming the various concepts of computer graphics are often more a source of difficulty to the student than the concepts themselves. Therefore it is essential that readers implement many of the program listings given in the book in order to understand the algorithms, as well as attempt a large number of exercises. As an extra learning aid, a companion audio-cassette tape is being made available; this contains most of the larger program listings given in this book. If readers are nervous of the mathematics, they should run the programs first before studying the theory.

This approach to the subject has been used with great success in teaching computer graphics to undergraduates and postgraduates at Royal Holloway College. Quickly producing apparently complex pictures results in the positive feedback of enthusiastic interest. The ability to construct pictures on line-drawing and colour interactive graphics screens makes a long-lasting impression on students; and the step-by-step approach brings them very quickly to the level of very sophisticated computer graphics. That level is outside the scope of this book, but where necessary readers will find relevant references to guide them into the more advanced topics.

This book is aimed at those who are competent BASIC programmers but complete beginners in graphics. It contains the elementary ideas and basic information about pixel and two-dimensional graphics, which must be mastered before attempting the more involved ideas of character and three-dimensional graphics. This is followed by a section relating to character graphics and the display of data (in line drawings and colour) – probably the most important non-specialised, commercial use of computer graphics. Later chapters introduce the reader to the geometry of three-dimensional space, and to a variety of projections of this space on to the two-dimensional space of graphics devices. The related problems of hidden lines and hidden surfaces, as well as the construction of complex three-dimensional objects, are dealt with in detail. Finally, we return to advanced ideas in BASIC programming and a large worked example of a video game.

Graphics is one of the most rapidly expanding areas of computer science. It is being used more and more in the fields of Computer Aided Design (CAD), Computer Assisted Management (CAM) and Computer Assisted Learning (CAL). At one time it was only the big corporations such as aircraft and automobile

manufacturers that used these techniques, but now most companies are realising the potential and financial savings of these ideas. What is more, not only is computer graphics profitable, it's fun! The Sinclair Spectrum is an ideal machine on which to learn the basics of computer graphics, and an excellent springboard to the most sophisticated (and expensive) graphics devices.

We hope this book will display some of the excitement and enthusiasm for computer graphics experienced by us, our colleagues and students. To demonstrate just how useful computer drawings are for illustrating books and pamphlets, all the pictures here were drawn by computer specifically for this book.