

RASTER IMAGING AND DIGITAL TYPOGRAPHY

Proceedings of the International Conference
Ecole Polytechnique Fédérale Lausanne,
October 1989



Edited by
Jacques André & Roger D. Hersch

THE CAMBRIDGE SERIES ON ELECTRONIC PUBLISHING

Table of contents

RIDT organisation	viii
Preface	ix
Surveys	
R. HERSCH	
Introduction to font rasterization	1
D. ADAMS & J. ANDRÉ	
News trends in digital typography	14
Font design systems	
E. KOHEN	
A simple and efficient way to design middle resolution fonts	22
N. BILLAWALA	
Pandora: an experience with METAFONT	34
D. ADAMS	
abctefg: a better constraint driven environment for font generation	54
M. NANARD, J. NANARD, M. GANDARA & N. PORTE	
Declarative approach for font design by incremental learning	71
Character generation	
O. FAHLANDER	
A spline contour method with efficient filling	83
J. GONCZAROWSKI	
Fast generation of unfilled and filled outline characters	97
M. NANARD & J. NANARD	
An anti-aliasing method for low resolution fonts based on font structure ..	111
Kanji fonts	
C. OU & Y. OHNO	
Font generation algorithms for Kanji characters	123

S. ABE, M. MAEKAWA & K. SHIMIZU Fast display of high-quality anti-aliased Japanese characters	134
F. UCHIO, T. HIGUCHI, T. KITAHASHI, H. SANADA & Y. TEZUKA A method of normalizing appearance size of brush-written Chinese characters	144
Rendering using raster processing techniques	
T. DUFF Polygon scan conversion by exact convolution	154
M. CORTHOUT & E.J. POL A point containment algorithm for regions in the discrete plane outlined by rational Bézier curves	169
Character design for raster devices	
B. MAAG Shape investigation with bitmapped characters	180
I.J. TAMARI Digitalisation of hebrew fonts, or: some evolutionary evaluations	188
J. ANDRÉ & B. BORCHI Dynamic fonts	198
Design analysis and font management	
P.R. BOWDEN & D.F. BRAILSFORD On the noise immunity and legibility of Lucida fonts	205
D. ADAMS & R. SOUTHALL Problems of font quality assessment	213
R. DEBRY, A.W. GRIFFEE & J.P. HOFMEISTER Management of multiple font technologies in a distributed system environment	223
Character outline manipulation	
P. KAROW Automatic hinting for intelligent font scaling	232
C. BÉTRISEY & R.D. HERSCH Flexible application of outline grid constraints	242
E.H. DOOLLES Rendition of quasi-calligraphic script defined by pen trajectory	251

Raster imaging and curve fitting

C.A. WÜTHRICH, P. STUCKI & A. GHEZAL

A frequency domain analysis of square- and hexagonal- grid
based images 261

A.A. CLAUSER

A resolution-independent, area-continuous-tone image representation
and its application for high-quality printing 271**Appendix**

By way of a colophon 287

List of authors 289

Index 291

Preface

Raster Imaging and Digital Typography started in the sixties, with the development of graphic terminals and CRT-based photocomposition devices. Early matrix printers and video terminals already incorporated characters stored in matrix form. Significant progress has been accomplished since then. The advent of non-impact page printing devices coupled with powerful imaging microprocessors opened the way to full page middle-resolution raster printing devices. The definition and implementation of resolution-independent page description languages like PostScript allowed the materialization of an old dream of people working in the printing industry: high-speed proofing of composed pages containing text, graphics and images became possible.

The accuracy of rasterization algorithms used in the seventies for letter rendering on photocomposers was not crucial due to the high output device resolution (1200 dpi). Character rendering quality becomes a much more crucial issue on middle-resolution 300 to 600 dpi printers. In order to obtain the best possible characters on middle-resolution output devices, professional typographers and computer scientists should cooperate closely. Analysis of character rendering effects on different devices required in order to learn how to adapt font outlines and rasterization algorithms to the needs of different printing technologies. This set of problems is dealt with in the workshop sessions on Character Design, Outline Manipulation, Character Generation and Rendering.

Kanji fonts require special attention due to the large number of different ideograms as well as to their high stroke density. A special session is devoted to these problems. In further papers, methods for alias-free rendering of images are presented, new representations of scanned images are described and hexagonal grid-based images are analysed.

As well as the presented conference papers, the proceedings book of the International Workshop on Raster Imaging and Digital Typography (RIDT'89) includes both unpublished papers from the Workshop on Font Design Systems, which was held at Sophia-Antipolis, France in May 1987, and two introduction papers on new trends in digital typography and on font rasterization techniques.

The aim of this workshop is to present new research results in the field of raster imaging and digital typography and to bring together people from different scien-

tific, industrial and artistic backgrounds. The workshop offers the opportunity for a fruitful exchange of views between participants.

We would like to thank our conference secretary Marie-José Pellaud for the important organization effort, the reviewers and the members of the program committee for selecting the best papers and the authors for their active contribution to the workshop. We also would like to thank the Eurographics Association for having sponsored the event and the Ecole Polytechnique Fédérale de Lausanne for offering conference rooms and infrastructure.

Roger HERSCH

Debra ADAMS

Jacques ANDRE

By way of a colophon

This book corresponds to the proceedings of a workshop, which means dozens of authors. Years ago, in such a case, one came across books produced from camera-ready copy in which a hotchpotch of printers, fonts, and styles had been used. An alternative and rather expensive way was to typeset the book from papers considered as manuscripts.

Both Cambridge University Press and the editors of this book, the third in the *Cambridge Series on Electronic Publishing*, felt that, especially for a conference on typography, a homogeneous good-looking book could be produced, even from a heterogeneous collection of papers, in a third way that combined the methods used for the first two books in the series:¹

First, very precise guidelines (corresponding to the Cambridge University Press house style) were sent to each author. All of them abided by the layout, and a homogeneous book could have been produced from camera-ready copy, alas generally only at 300 dpi.

All the electronic sources were collected and processed at Rennes by Jacques ANDRÉ and the "Atelier IRISA". Despite a great number of formatting systems (such as DCF, Word, PageMaker, Quark XPress, Troff, etc.) and a great number of transport media (floppy discs at different sizes and densities, tapes, electronic mail etc.), all the texts have been successfully translated into L^AT_EX, using a style defined by Richard Furuta (Maryland University) and modified by Philippe Louarn (IRISA, Rennes).

L^AT_EX files were sent by electronic mail to Richard Southall at Rank Xerox Cambridge EuroPARC. Besides correcting occasional infelicities of English phrasing in some of the translated papers, he made detailed modifications to the T_EX font metrics and composition parameters to produce more legible output.

This book is full of illustrations. Most of them have been electronically pasted-up with PostScript, although they were initially produced with many different drawing systems (such as CricketDraw, MacPaint, Illustrator, etc.). Obviously some of them had to be pasted-up manually. Typical examples are photographs (e.g. page

¹*Document manipulation and typography* (Hans van Vliet, ed.), proceedings of the International Conference on Electronic Publishing (EP88), Nice, France, 1988;
Structured documents (J. André, R. Furuta & V. Quint, eds.), 1989.

94), 300 dpi output (e.g. page 182), or reproductions of printers' type (e.g. page 192).

The \LaTeX CUP style is defined to use Adobe Times, so high quality could be obtained from a PostScript phototypesetter. However, the book contains a large amount of mathematics, which is typeset with \TeX 's Computer Modern mathematical fonts. The \LaTeX DVI file was sent to Victor Ostromoukhov at Paris : using METAFONT, he was able to reproduce the outlines of the Computer Modern characters in a form compatible with PostScript.

Then, finally, all the text and all the PostScript illustrations were processed on a Linotronic phototypesetter by Imprimerie Louis-Jean at Gap, France. Offset printing was done in England from this film.

Jacques ANDRÉ

Richard SOUTHALL