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长名书 ADVANCES IN
NON-IMPACT PRINTING TECHNOLOGIES
FOR
COMPUTER AND OFFICE APPLICATIONS

THE SOCIETY OF PHOTOGRAPHIC SCIENTISTS AND ENGINEERS
PROCEEDINGS OF THE
FIRST INTERNATIONAL CONGRESS
VENICE ITALY
JUNE 22-26, 1981

EDITED BY
JOSEPH GAYNOR
INNOVATIVE TECHNOLOGY ASSOCIATES



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FOREWORD

Alvin Toffler, in his book The Third Wave¹, and others have described this period in modern society's evolution as a transition from the "industrial revolution" to a "knowledge or information revolution". Labor statistics plus market and business data provide confirming evidence. Some of many examples follow.

- The ratio between white and blue collar workers has been and continues to grow at an ever-increasing rate.
- Automation in factories and on farms has contributed heavily to increases in productivity. Although the advances are continuing, maximum gains have long since been made.
- Information technology advances combined with progress of indirectly applicable technologies such as electronics, communications, computers, and imaging have made automation of office work technically and practically feasible.
- Relatively sophisticated computers for the home and small businesses have become affordable and attractive.
- Home terminals for access to vast centralized information centers are a near term potential reality.
- Computers are taking over more and more routine business tasks, e.g. bookkeeping, accounting, data acquisition, inventory control, ordering, billing, etc.
- The systems concept wherein terminals with various levels of intelligence are associated with a large central computer has become increasingly popular due to the favorable cost effectiveness and general utility.

¹ Alvin Toffler, The Third Wave (New York, N.Y.: William Morrow Co., 1980).

All equipment which interfaces with a human being must provide information input means for transmission, manipulation and/or storage, and humanly comprehensible information output means, i.e. print or voice. Despite all the negative comments about paper and paper work plus the continued predictions that transient electronic techniques of various kinds will replace paper, the volume of printed material from copy machines, duplicators, computer printers, facsimile and teletype machines continues to increase and is predicted to grow at about the same rate for at least the next decade or so. Consequently, despite the healthy growth rate of display and voice technologies and devices, most of the output is now and will continue to be black print on white paper.

As the number of devices finding their way into homes, small businesses and offices increases, the advantages of non-impact printing over conventional impact printing methodologies become more and more significant, i.e. quieter, cleaner, smaller, less maintenance, more versatile, better print quality, wider choice of fonts, higher speeds, graphics, pictures, color... Consequently, the trend to non-impact printing devices has been gathering momentum and its growth is predicted to continue to accelerate. Rapidly growing markets, product proliferation and optimistic business projections stimulate enhanced research, development and engineering work along with other endeavors. It seemed to follow therefore that there would be a great deal of recent reportable technical progress in several relevant areas. Thus, with intense interest also a foregone conclusion, an international congress devoted to technological advances in non-impact printing technologies seemed most appropriate.

Although the charter of the Business Graphics Technical Section of SPSE encompasses this area, the credit for suggesting the meeting as well as its location belongs to Dr. Arnaldo Pasini, Corporate Director of Research, Olivetti. He was well aware that no meeting on this topic had been held anywhere in the world as of that time despite considerable technical and business activity in Europe, Japan and the U.S. He offered to become personally involved and Olivetti indicated a willingness to cooperate by providing assistance of whatever kind might be needed. His leadership as General Chairman was essential to the success of the Congress as was Olivetti's support and encouragement.

In order to ensure participation from the three major geographic areas, Program, Publications and Session Chairmen were appointed from Europe, Japan and the United States. Their names and responsibilities are shown below:

Program Co-Chairmen: Ulf Rothgordt, Philips GmbH

Eiichi Inoue, Tokyo Institute of Technology

Joseph Gaynor, Innovative Technology Associates

Publications Co-Chairmen: F. Bestenreiner, Agfa-Gevaert A.G.

Y. Nakajima, Fuji Photo Film Co., Ltd.

John M. Schneider, Xerox Corp. (now
at Mead Corp.)

Session Co-Chairmen:

Session I - Interfaces with Major Application Areas - The Use

Context -- J. Gaynor, Innovative Technology Associates;

Y. Nakajima, Fuji Photo Film Co., Ltd.; U. Rothgordt, Philips GmbH.

Session II - Technologies Basic to Photo and Electronic Printout --

R. C. Ahuja, University of Gottingen; N. Hoshi, Hitachi Ltd.;

M. D. Tabac, Xerox Corp.

Session III - Thermal Processes and Media -- J. H. Boyden,

Hewlett-Packard, Inc.; S. Nakaya, OKI Elec. Ind. Co., Ltd.;

G. L. Ponzano, Olivetti S.p.A.

Session IV - Ink Jet -- H. Fukuchi, Nippon Electric Co., Ltd.;

H. Hertz, Lund Institute of Technology; D. S. Swatik,

Computer Peripherals, Inc. (now at Documation, Inc.)

Session V - Electrostatic Systems -- R. A. Fotland, Dennison

Manufacturing Co.; R. Miida, Mitsubishi Electric Co.;

G. Wessel, SEL-Forschungszentrum.

Session VI - Magnetic Processes and Media -- W. H. Meiklejohn,

General Electric Co.; M. Mizuguchi, Toshiba Corp.; F. Neema,

CII-Honeywell Bull.

Session VII - Perspectives on Impact vs. Non-Impact Printing

and Some Applications -- F. Agostinucci, Olivetti S.p.A.;

D. W. Hamill, 3M Co.; I. Kondo, Fujitsu Laboratories, Ltd.

Session VIII - Laser, LED and CRT Electrophotographic Systems --

Y. Hoshino, Nippon Telegraph & Tel. Public Corp.; J. B. Merry,

Jamieson Science & Engineering, Inc. (now at Chesapeake

Laser Systems, Inc.); J. van Engeland, Agfa-Gevaert N.V.

Session IX - Future Directions of Non-Impact Printing Technologies

Panel Discussion -- Mediator: A. Sporer, I.B.M. Corp.

Sessions II - IX were more or less originally planned as depicted above with

the usual allowances for changes depending on the nature of the papers received. The response to the call for papers plus specific invitations extended to individuals and organizations known to be doing advanced work in selected areas was so substantial and enthusiastic that most sessions were filled very quickly. In addition, the Program Committee was forced to be selective in many cases, expand and change the scope somewhat and increase the pre-planned duration of the meeting.

Over a full five day period, 74 papers were presented in addition to the panel discussion. Despite tight economic conditions there were more than 275 attendees from 14 countries. Enthusiasm about the Congress was so high that they voted to hold a second one within the next two or three years. Preliminary inquiries are underway in Japan and Europe and a suggestion for another in the U.S. has already been made.

Despite the fact that these Proceedings are devoted almost entirely to technical matters, it is seemly that other facets of the Congress be described briefly and non-technical contributions to the success of the meeting be acknowledged. Due to the large number of papers, presentation time was very limited and there was virtually no time for discussion or questions. Consequently, author interview sessions were scheduled at the end of every day. Small groups of individuals got together with each author to ask questions or discuss topics of mutual interest in a somewhat less formal, more intimate environment. These get-togethers often lasted two or more hours beyond the end of the regular day which had already covered a full eight hour period. Social events were scheduled in order for the attendees

to get to know each other informally and for the benefit of the many families who accompanied the congregants. The Sunday evening before the formal opening of the Congress, there was a wine and cheese party for all attendees and their families. Judging from the length of time people stayed and the many small groups which kept forming, breaking up and reforming, this ice breaker (which was jointly sponsored by the Xerox Corporation and SPSE) was very effective. Later in the week, Olivetti sponsored a concert at La Fenice, a historic hall very close to St. Mark's Square. It was very well attended and greatly appreciated by everyone present despite a very heavy downpour. The Thursday evening banquet was held at the Excelsior on the Lido so that those who attended, the majority of the Congress participants, had the benefit of a very pleasant and somewhat exciting speedboat ride. In true European fashion, the decor was elegant and the food excellent. Moreover, we were privileged to hear Mr. Franco De Benedetti, Managing Director of Olivetti present a philosophical, thought-provoking and very interesting address. The text follows this Foreward.

The technical sessions were held on the island of S. Giorgio in a conference hall which is part of the Fondazione Cini. Perhaps because of its great age, the acoustics in the conference hall were excellent. The island itself is away from the hustle and bustle of Venice in the summertime. The surroundings were originally designed to encourage study and introspection. It therefore constituted an almost perfect setting for the Congress. During coffeekbreaks and for a little while after lunch, small groups could be seen strolling the grounds, engaged in conversation, weather permitting.

The man who orchestrated all logistics and arrangements including the banquet

registration, placement of attendees and participants at various hotels throughout Venice, lunch every day, plus other things I may never learn about, was Mr. Carlo Marselli of Olivetti assisted by his charming and efficient wife, Luciana. The fact that every attendee had a place to stay and that the Congress ran smoothly is more than ample testimony to their efforts and substantial contributions. The SPSE staff in Washington was a near-perfect model of efficiency and tact during the preparations for the Congress. The Congress Committee is also indebted to the Business Graphics Technical Advisory Board for suggesting potential authors, publicity for the Congress and general guidance.

Advisory Board: Paul M. Cassiers, Agfa-Gevaert N.V.; Howard Daly, Eastman Kodak Co.; Dennis Hamill, 3M; Eiichi Mizuki, Fuji Photo Film Co.; Toshiyumi Sakata, Tokai University; Alfred Sporer, IBM Corporation; Mark D. Tabak, Xerox Corporation; Joseph Gaynor, Innovative Technology Associates.

Last but far from least are the SPSE Conferences Vice President, Dietrich Schultze and Executive Director of SPSE, Robert H. Wood. Dr. Schultze had a strong hand in convincing the Society's Board of Directors that this Congress was a proper forum for SPSE sponsorship. He also provided valuable encouragement and support to the Congress Committee from the very beginning. Wood's experience, expertise, guidance and steady nerves provided material and moral support from Washington during the preparatory stages and in Venice at the Congress itself.

As the time for the Congress approached and the extent of interest became

more and more evident, it was decided that the proceedings of this meeting merited publication. Accordingly, authors were so informed and full manuscripts requested. Of the 74 papers presented, 70 were submitted and manuscripts pertaining to the content of the panel discussion have also been received. Your editor wants to extend special thanks to all the authors for taking the time and trouble to prepare and submit the manuscripts. In order to publish the Proceedings in the shortest possible time, it was decided not to referee or edit them. Therefore, readers will note variable format, some typographical errors, etc. In no case, however, do these minor flaws degrade either comprehension or technical merit. Special thanks are also due Dr. Bestenreiner who collected the many papers by European authors and sent them as a group. The SPSE office staff has prepared the index at the end of this volume and has also arranged for timely printing and publishing.

In the interests of uniformity, coherence, maximum effectiveness and logical order of presentation, this volume has been organized into the eight chapters shown in the Table of Contents. Most but not all chapter titles correspond to those of the technical sessions. An even further departure has been made in the content of the chapters themselves. The sequence has been changed in almost every case, papers have been moved from one area to another and several were assembled to form a new chapter. These improvements were possible simply because the content of all the papers was available. Although all the papers were read quickly, in no case was there an attempt to assess quality or significance. Chapter selection and location within a chapter were determined only on the basis of optimum fit.

Each chapter begins with an introduction which includes a few comments about the general significance of the topic, the content of the chapter, the highlights of each paper and citations of other related papers in this or another chapter. Authors and readers alike are assured that if there are misunderstandings and misinterpretations they are purely unintentional and the full responsibility of the editor.

As Editor of these Proceedings and a participant in the Congress, it has been a pleasure to become acquainted with the many authors and co-authors, the Congress attendees and those who have had a large or small hand in making all this happen. I am eagerly looking forward to the next one, wherever it may be.

Joseph Gaynor
Editor

1. Since we are at table, you will I hope allow me a rabelaisian reference, which is in no way intended to be an allusion to gargantuan feasts.

My reference comes from that marvellous fourth book, when the giant sets sail to go and consult the oracle of the goddess Bacbuc, and after much misfortune, reaches the edge of the mer Glaciale where he finds the "frozen words".

The "great and cruel battle between the Arismapienses and the Nefelibates" had taken place there at the beginning of the previous winter. The cold had suddenly frozen "in mid-air the words and cries of the men and women, the whirl of the clubs, the clash of the weapons and harnesses, the neighing of the horses and all the uproar of battle." And when Panurge asks to see some of these words close up, Pantagruel seizes a handful and throws them on the deck where they "lay like multi-coloured pearly confetti... We were able to make out rampant words, brown words, blue and black words, gilded words, which, having been warmed by our hands, melted like the snow, and then we were truly able to hear them, even though we did not understand them, because they came from a barbarian language".

When Rabelais was writing this fourth book, the printing press was completing its first hundred years of existence. It is remarkable that it should have been this writer of quips and jokes to give us this intuition, this metaphor for movable type, which by then was being cast in lead and instantly hardened, like words which suddenly freeze, this allusion to the written word, ready to melt at the first contact with human warmth, to unleash its sounds and explode in the recreation of events: "Gog and Magog," continues the narrator, "and who knows

what other barbarian words, the sounds of the attack and the neighing of the horses at the moment of impact; and then we heard other great words, which on melting produced the sounds of drums and pipes, of horns and trumpets..."

The rabelaisian metaphor seems to allude to the extraordinary density of meaning and logical thinking which are involved in the concept and practice of writing, down to the formation of knowledge.

Therefore, while writing is first of all the physical or mechanical action of drawing a symbol, it is also a technique of enunciation, as a style it is an esthetic form of expression. Then it is also book-keeping, and, as the Holy Scriptures, it is a store of religious revelation.

The essence of writing lies on one hand in the drawing of a symbol, on the other in being a form of communication. It is a means of creating a collective memory from an individual one, an interrogation of the subject (why has this been written) and a description of collectivity (what does the writing achieve). It is the expression of a personal secret and a contribution to the formation of a social consensus.

We could therefore examine the relationship between writing and speaking, between writing and reading, between writing and remembering.

It would perhaps be an abstraction to consider whether writing has its own "place", whether or not it is reductive in relation to the immediate meaning of the written language, whether or not it is part of our exterior selves, whether it really is silent and dead compared to "living" verbal communication and immediate pictorial communication.

In more concrete terms, writing is related to the social forms within which it has historically developed: in other words it is related to social organisation, to the structuring of power.

Since the development of social structures is in turn determined by methods of production and economic factors, links are also created between writing and economics.

Finally, writing is literally a technique for drawing intelligible symbols. The first and most direct way in which a relationship is established between written material and its user (the reader) is as the perception of graphic symbols, virtually independently of their information or truth content.

2. The evolution of writing, which is itself a way of producing language, has always been influenced by our methods of producing material goods.

The first pre-alphabetic scripts (notching, knots) developed, in the Mediterranean area at least, in Palestine, as agricultural production methods were established and the need arose to quantify stocks, count goods, anticipate the changing of the seasons.

Writing was not a literary or religious necessity, but a means of keeping records of economic and administrative transactions, as the seven hundred thousand clay tablets found in Mesopotamia demonstrate.

A parallel has been drawn between the invention of the alphabet, and the invention of money: both respond to the need to reduce the multiple variety and solidity of words and goods, to the abstraction and universal functionality of letters and coins: exchanges of information and exchanges of goods developed in parallel, and the growth of both required the invention of a neutral agent.

Moreover, writing itself could become a commodity, and, in time of war, a commodity to be conquered, either by capturing slaves who knew how to write, or by gaining control of an alphabetic or ideographic methodology.

The ability to write was divisive. Today when the democratisation of writing is complete almost everywhere, persisting teleological prejudices make us think of writing as a means of communication, as a means of uniting men. Historically, however, writing was power: scribes could become kings or, at the other extreme, as slaves they would be exploited by their

masters. A trace of this lingers today in the division of work between the person who dictates and the person who writes, or when we assess a person's cultural level from his handwriting. Clearly today the distinction has shifted from knowledge of the alphabetic language to facility in employing the formalized languages and the algorithms of the quantitative sciences (but even music and formal logic have their symbols).

Written communication is of course erasable, unlike verbal communication: but afterwards it is a physically permanent, immutable object.

The word of God created the world, but the tables of the law govern it. It is the permanence of the written symbol which renders it a medium not only for the truth which is intended to be eternal and unchangeable, but also for the perpetuation of the authority of the sage, and for its continuing possession by power.

Levi-Strauss mentions that when he showed writing to the Nambikwana Indians, their chief began to imitate it immediately, drawing wavy lines; showing that he perceived the ideological function of writing as power, rather than its intellectual function as knowledge .