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INTRODUCTION

Signposts and Monasteries on the Digital Highway

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This issue of Leonardo Electronic Almanac contains two sections. First is an issue of Leonardo Digital Reviews (LDR) with reviews of exhibits, software, digital and print publications of possible interest to our professional community. We encourage artists, authors and researchers to contact LDR if they are interested in serving on the LDR review panel, or having their projects or publications reviewed. Send email to [davinci@uclink.berkeley.edu](mailto:davinci@uclink.berkeley.edu)

The second section is an issue of Leonardo Space Arts News. This occasional publication has not appeared in some time, and this new issue will be the first of several. Space Arts News seeks to address all aspects of space exploration and culture.

These two sections of LEA illustrate two strengths of the use of the Internet for arts communication. LEA reaches a global audience of interested colleagues. Publication is rapid, and LEA can rapidly respond to the changing interests of readers, authors and editors. Leonardo Digital Reviews was created to respond quickly to a perceived need: there is a proliferation of new arts related publications and arts activity in print, on-line and in digital media - but the increasing information overload makes it more and more difficult to locate relevant and significant new materials, projects or information. We need guideposts to interesting places on the digital highway. Leonardo Digital Reviews is the result of "filtering" by a review panel of interested and competent colleagues. Through LDR, they will try and point out what new activities warrant further attention and why. The LEA ftp site and future WWW/Mosaic site will accumulate these guideposts. We encourage our readers to help create this ever changing map.

Space Arts News represents the opposite extreme. The Internet allows individuals who are widely dispersed geographically, but share intellectual interests to find each other and create a professional community. The number of people on this planet who are active and interested in art and space or culture and space exploration is very small. But these individuals are passionate and convinced that their interest is important and vital for the arts and culture of the future. Just as the monasteries of the dark ages provided havens for small groups of professionals to work on topics considered esoteric or irrelevant by the world at large of the time, so the internet promotes the growth and survival of passionate interest groups working on topics considered esoteric by today's world at large. If the human species succeeds at creating cultures outside the home planet, then the work of space artists will be the cave art of future civilizations. Readers interested in being kept informed and contributing to the discussion through our space-arts email exploder, should send email to [davinci@uclink.berkeley.edu](mailto:davinci@uclink.berkeley.edu)

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LEONARDO DIGITAL REVIEWS
MAY 1994

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Leonardo Digital Reviews (LDR) is an electronic review journal published regularly as a section of the Leonardo Electronic Almanac. Leonardo Digital Reviews covers publications, conferences, events and publicly presented performances and exhibits. The focus is the work of artists, scientists, technologists and scholars dealing with the interaction of the arts, sciences, and technology. Topics covered include the work of visual artists, composers, and multimedia artists using new media and technologies in their work, artists dealing with issues and concepts from contemporary science, the cultural dimensions of science and technology, and the work of scholars and historians in related fields. Preference is given to reviews of on-line or digital publications, events and works, but reviews of work in other media are also included.

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< EXHIBITION REVIEW: Color in the Shadows: Bay Area Cyberart >  
Oliver Art Center, California College of Arts and Crafts,  
Oakland, California, U.S.A., 26 January - 5 March 1994

Reviewed by Sonya Rapoport, 6 Hillcrest Drive,  
Berkeley, CA 94705, U.S.A.

The selections in "Color in the Shadows: Bay Area Cyberart" vary widely in media, concept, and scale. Curator Mark Bartlett considers this exhibition "a boundary marker at the intersections of art, science and technology."

Artists included are Jim Campbell, Paul DeMarinis, Lewis DeSoto, Douglas Hollis, Ned Kahn, Bernie Lubell, Peter Richards, John Roloff, Mark Thompson, Gail Wight.

The sensational opener is Bernie Lubell's huge "Three-Body Problem, Two-Body Problem," a Rube Goldberg-like contraption that appears to be made of balsa wood. Words occasionally pepper its surfaces, playing games with the viewer. The mechanical intricacies of this beautifully crafted, zany rocking-chair sculpture cut through the wall into the next room to expose pompously its complex linkages and sagging springs. Painstakingly contrived, this ad hoc assemblage belies any anticipated response one might experience if sitting in the chair - if one would dare. This invitation to participate introduces an interactive theme evident in Jim Campbell's neighboring installation.

Jim Campbell's "Shadow (for Heisenberg)" is the most sophisticated high-tech spectacle in the exhibition. Conceptually, this work illustrates Heisenberg's Uncertainty Principle, which states that nothing can be accurately measured and that the element introduced in measurement affects the measurement itself. Aesthetically, Campbell's work grapples with interactivity in a unique way.

Perhaps because the piece is included in this milieu, it dons an artistic luster that might not be evident in the context of a more high-tech arena. But here, instead of being displayed as an object, it is dropped into its own cubicle as an installation and the lack of relationship to

open space tarnishes its aesthetic potential. If situated openly in the gallery, "Shadow" might have been more successful as a self-contained sculpture.

The viewer sees a clear box in which a small Buddha resides. Campbell describes his selection as "almost a cliché, but it works in terms of the piece being about not seeing what you want to see." [2] As the viewer approaches the work, a list screen gradually obscures it, preventing the viewer from getting a closer look. This kind of interactivity contrasts with most other interactive work, where viewer/participants can control what they wish to see.

Black-and-white images are projected onto the wall from the far end of the box. These ectoplasmic projections comprise changing, irregular forms that dwarfishly reflect the viewer's feverish attempts to look into the box. If these reflections were large enough to engulf the space and therefore emphasize the spectator's search, the total effect might have been more dynamic.

On the other hand, Louis DeSoto offers a video installation perfectly scaled to its enclosed space. He says that it is "based on a simple media phenomenon" [3]. I interpret this work as pure audio/visual abstraction. Or, taking my view a step further to enrich the experience, I could alternately view the piece as an animated version of the quintessential minimalistic art of stripes across a canvas. DeSoto's piece calls to mind a number of contemporary artists, for example, early Frank Stella, Brice Marden or Agnes Martin.

A more temporal piece, but one that contributes dramatically to the overall character of the exhibit, is John Roloff's "Rotting Flame". This towering construction, a tree-like form of steel and real oranges, protrudes horizontally from the wall. As a complement, rekindling the flame-like form of the tree, an adjacent videotape displays images of fire through which scrolls a visual mantra of the names of physiologically active chemical compounds.

Gail Wight broadens the scientific context of the exhibit with her "Somatology Blisters", a series of eye droppers and test tubes labeled and filled with bluish liquid; the test tubes are secured on panels and arranged in a grid. This imaginative spread sheet of neurotransmitters offers a simple device for stimulating our central nervous system. "Extreme nostalgia," "hysteria," "ambivalence," "conscious dream state" and "terror" are some of the conditions listed on the test tube labels. Visually eye-catching but inaccessible, Wight makes it extremely difficult for the art "pilgrim" to "mount the steps" and read the work. I was barely able to decipher these printed words half-hidden and buried upside-down in the solutions. Her natural science emulation piece, "History of Wishing", also hard to reach, prompts two observations:

- (1) Is this another kind of interactivity?
- (2) Why does labor-intensive graphic artwork induce tedium while arduous high-tech projects produce magical wonderment?

In this exhibition, fantasy, playfulness, humor, scale, variety, color, language and psychology are used to manipulate the technological and scientific information toward an aesthetic validity.

#### References

1 and 2. Artist's discussion with Steven Jenkins, "Artweek",  
17 February 1994.

3. Artist's exhibition statement.

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< COMPUTER SOFTWARE REVIEW: Woggles from Oz: Writing Interactive Fiction >  
Joseph Bates, et.al., Carnegie Mellon University

Reviewed by Benjamin C. Pierce, Department of Computer Science,  
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The term "interactive fiction" describes any artifact -- whether it be a book, theater script, image, automaton or computer program -- that allows a reader to make choices that determine the unfolding of a story. Adventure, a textual computer game developed at MIT in the 1970s, is the patriarch of the genre. An Adventure "document" is a simple network of nodes representing places and links connecting them. A link can be traversed by typing its name, and each node carries some descriptive text -- anything from half a page to a pithy phrase such as "You are in a twisty little maze."

For the author, these primitive building blocks place few obvious constraints on the kinds of stories they can be used to tell; but in fact, the constraints are severe. The activities of non-reader characters cannot readily be described in such a static framework; nor are all kinds of scenes amenable to description in terms of nodes and links. An even more serious problem is the exponential branching of storylines. If the first scene offers a choice of two doors, the author faces the task of writing two complete sequels instead of one; in each case, another choice appears soon afterwards and the situation can quickly become unmanageable.

Oz, a new interactive fiction system under construction at Carnegie Mellon University (CMU) by Joe Bates and his students, vastly extends some of the creative options offered to the author by Adventure, while limiting others. Like Adventure, Oz can be used in an "expressionist" mode to simply construct an interesting world for the reader to explore. But the richer structure of an Oz document actually inhibits this sort of use. In Adventure, the author is free to use all the expressive resources of English to describe a scene. In Oz, it is the system that describes scenes to the reader: the author's job is literally to "build" them, gluing predefined pieces into larger edifices like electronic Lego blocks. This done, the system generates textual descriptions that take into account factors such as the reader's focus of attention and the rearrangement of props during the story.

In 1992, the Oz group at CMU decided to bring their ideas together with work on real-time animation. The result was the world of the woggles, imaginary land creatures with expressive eyes and shells of brightly colored putty, living in a storybook landscape on the screen of a state-of-the-art graphics workstation. Because they lack mouths, their means of communication are simple: bobbing up and down to signal greeting, hopping back and forth, sulking, and, when angry or threatened, gathering themselves up into menacing discs. Some of the woggles are controlled by the Oz system, using a simple model of their goals, habits and emotional states to determine their visible actions. One of them is controlled by a human reader sitting at the workstation: pointing with the mouse makes the woggle hop to the indicated place on the screen; pressing buttons produces greeting or threatening motions that the others

can see and respond to.

In a strict sense, this is not interactive fiction: we are free to impose a narrative reading on the events unfolding on the screen, but this is entirely a matter of interpretation after the fact; there is no story designed into the system itself. Even so, the immediacy of a graphic presentation evokes the creative possibilities of the new medium much more powerfully than its text-based predecessors.

Besides demonstration pieces, the Oz project has produced solid scientific results, including Mark Kantrowitz's work on automatic generation of realistic English and Bryan Loyall's modelling of characters with emotions. Moreover, as pure entertainment this is clearly a technology of the future; it is no accident that Oz has received substantial funding from Japanese game manufacturers. But what, artistically speaking, does it come to? Is the simple sequence of events really such an important element in the stories we enjoy hearing and telling? When reading a Shakespeare play or a yarn by Mark Twain, we respond to the narrator's wit, verbal music and skill in showing characters from revealing angles. These qualities may also be present in a work of interactive fiction, but they do not depend on its interactivity for their effect. Of course, there are literary forms where interactivity in the literal sense might enrich the reader's experience. Authors of mystery stories go to great lengths to let readers second-guess the super sleuth. Why not just let the reader "be" the detective? But even in these forms, the difficulty of writing interactive fiction may seriously limit its uses.

A system like Oz is an experiment in illusion. The linguist William Croft once remarked that the famous computer psychoanalyst, Eliza, which succeeded in fooling a surprising number of people by using a tiny set of stock responses ("Tell me more about your mother..."), was a revelation less of its audience's gullibility than of an astonishing regularity in a certain kind of discourse. In this respect, the earliest versions of Eliza are probably the most successful: as more mechanisms are added to make the program "understand" a broader range of inputs, its actual lack of understanding becomes more and more apparent.

Moving from conventional, linear text to Adventure's web of nodes and links, the author confronts an explosion of plot possibilities. In systems like Oz, where the "document" is a tiny artificial world, this explosion is mirrored by a proliferation of complex interactions among its constituents. The author's attention is increasingly distracted from literary or dramatic effects to the intricacies of constructing props, sets, and scripts that will interact properly to produce these effects. Ultimately, the tasks of writing and programming -- each of which is more than difficult enough in itself -- begin to blur. To avoid overwhelming the author, designers of interactive fiction systems must find smooth regions in a vast space of possible designs: technologies that achieve precisely the right level of sophistication and that, together, can create seamless effects.

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< BOOK REVIEW: Interactive Music Systems >  
by Robert Rowe. MIT Press, Cambridge, MA.

Reviewed by Axel Mulder, Koninginneweg 135-2, 1075 CL Amsterdam, the Netherlands. E-mail: a.mulder@elsevier.nl

The first thing that caught my attention when reading this book was the fact that it is based on Rowe's PhD thesis. In many cases this can be a drawback, because the field of view of a PhD student can be very limited. However, such in-depth research can sometimes also reveal interesting discoveries. It should be noted that Rowe was the first composer to be awarded a PhD from the MIT Media Lab. As for the coverage of the book, Rowe uses his system, "Cypher," as a guideline throughout the book but does not forget to mention many others active in the field. The index testifies of this.

One of the persons Rowe spends some pages on is George Lewis, who, in fact, also performed with Cypher. I asked George about the book and the field. He said interactivity is going to be "hot" for the next few years, and that the book may therefore serve a developing market. The idea of the book is to propose (quoted from the preface) "a consideration of building artificial performers and improvisers that quickly recognizes the relevance and potential contributions of those other fields. Other texts will detail those relationships: this one shows why interactive music systems are unworkable without them." Its aim is certainly not to provide a comprehensive overview of the myriad of activities in this interesting, multidisciplinary field; the author emphasizes that such coverage is impossible. At any rate, more than 300 pages (278, to be exact) would be needed for such a daunting task! The field draws from many well-established areas, as can be seen by taking a sample from the table of contents: chapters are devoted to live computer music, music theory and music cognition, machine listening, machine composing and artificial intelligence. Again, Rowe has not attempted to cover these fields and their relationship in depth in one chapter each. It is clear that the book has been written for the educated reader who is already familiar with the basics of these fields.

Looking more closely at the actual contents of the book, I found myself attracted to the chapter on improvisation in live computer music, a topic that particularly interests me. I have always been struck by the "non-liveliness" of computer music, as compared to music that is performed by humans. The debate on how to model human expression in performance is ongoing. Can it be done? Rowe discusses work by others on this fundamental issue, such as the aforementioned George Lewis, Richard Teitelbaum, Jean Claude Risset, David Jaffe, Andy Schloss, David Wessel and Cort Lippe. However, the chapter is mainly devoted to his own system, Cypher. In Rowe's treatment of commercial interactive systems MAX is the word; M and Jam Factory are also mentioned. It is true that MAX is a great piece of software and today's "lingua franca," but there are more systems to discuss: HMSL by David Rosenboom (whose work in the field predates Rowe's by quite a few years, but who is not mentioned in the book), ForMuLa by Ron Kuivila, Interactor by Morton Subotnick and Mark Coniglio . . . George Lewis commented on the MAX proliferation by saying: "As you know, the use of Forth as a language for making interactive pieces predates the existence of MAX by at least 8 years. Well before MIT and IRCAM devised MAX, pieces were shown by Daniel Scheidt, David Behrman, Ron Kuivila, Nick Collins, Rich Gold, Martin Bartlett, Norman White, Michel Waisvisz, John Bischoff, Tim Perkis, Laetitia Sonami, Liz Phillips, Joel Ryan, and quite a few others. In many ways, I feel that MAX is the institution-based computer music's answer to the need for musicians and composers for an interactive approach, not to performance, but to the composition of the work. . . . Before MAX became important, the same group of people were very excited about Lisp-based environment."

It may also be called an advantage that the book isn't crammed with pages full of descriptions of all kinds of soft- and hardware systems suitable for the creation of interactive music systems. Instead, Rowe focuses more on underlying principles and theoretical considerations, while discussions of practical performance experiences are sufficiently incorporated. As Lewis put it: "Robert's book is excellent, but does not, I feel, pretend to be an exhaustive look at interaction as a field. . . . Robert's article

is oriented toward computer composition and recognition of patterns. This is only one part of interactivity. . . . Really, an attempt to be comprehensive would be rather irresponsible in my view. His book is a very well-documented, narrowly directed work that attempts to cover many important issues. How well he deals with those issues is more important to me than any attempt at a survey of the field. To my knowledge, Robert's book is the first to deal explicitly with interactive computer performance, though there are many articles. There is lots of room for more."

The book comes with a CD-ROM full of music and software, some of which requires the presence of other software programs such as SmallTalk, LISP, or MAX. Cypher will run on any Macintosh without further specific support. E-mail addresses of the authors of the software are listed in the Read Me file on the CD-ROM. I have tried out a few of the MAX patches and some are quite intriguing. The author clearly states in the Read Me file that some parts of the software may not run, so I was warned. Indeed, some patches need specific objects to be installed properly, so users need to be informed about MAX's workings and setup. Some patches did not immediately put me into a "wow" mode. It seemed as if these patches were merely meant to demonstrate MAX in the context of interactive music systems, which is somewhat below the level the book aims to reach, in my estimation.

I was also concerned about the availability of the software supplied on the CD via the internet, i.e. for free. A quick check of three archives for music software showed me that most of the patches on the CD were not available through ftp from these sites. At the very least, Stephen Pope's contribution to the CD, "MODE," is available via the Internet.

Other contributors include Jeff Pressing, Miller Puckette, Zack Settel, and all of the above-mentioned names except George Lewis and David Wessel. The CD also contains excerpts of a number of pieces that were publicly performed, among them "Maritime," a piece that was composed by Rowe for violinist Mari Kimura. According to her, Cypher is very reliable and conducive to expressive performance. I found most of the pieces very interesting, especially those that make intensive use of real-time sound processing. It is somewhat unfortunate that the pieces were not recorded in full on the CD, because excerpts may give the listener the feeling that the whole piece resembles the fragment, when interactive systems, if they are sufficiently complex, can actually allow very weird and unexpected things to happen. Nevertheless, some interactive music systems also tend to be somewhat indecisive about where to mark the beginning or the end of a piece, so that one CD might not even be enough . . . All in all, the music and software are both quite interesting collections that, together with the book, will make for some lost nights for many of us.

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< BOOK REVIEW: The Music Machine >  
by Curtis Roads. MIT Press, Cambridge, MA. \$25.00.

Reviewed by Axel Mulder, Koninginneweg 135-2, 1075 CL Amsterdam, the Netherlands. E-mail: a.mulder@elsevier.nl

"The Music Machine" is an anthology covering many aspects of electronic music. The chapters are reprints of articles originally published in a well-known journal in the field, "Computer Music Journal," which Curtis Roads, editor of "The Music Machine," edited for many years.

The book opens with six interviews with pioneers in the field, such as Max Mathews, James Moorer and Clarence Barlow. The interviews are especially useful because they allow the reader to gain some insight into the motivations that have driven developments in the field, instead of just being confronted with



the developments themselves. It seems to me that developments in this field are driven more by personal motivations than by the needs of society in general.

Logically, composers play an important role in this book as well -- 12 articles are devoted to various aspects of composition in the digital domain. MIDI (two articles) and music software (13 articles) are also well covered. It should be mentioned, though, that the subject of music software is discussed in quite a product-dependent way, which makes it appear somewhat out of date. However, an equally valid consideration is that the techniques implemented in the software of earlier times still apply today. This is especially the case with the section on synthesis and signal processing (12 articles), in which signal processing hardware is presented in only four of its articles. However, while developments in this field are proceeding rapidly, it is an area that appeals to the reader interested in computer music only up to a certain level. Music and artificial intelligence are covered in only four papers. To my knowledge, there is a significant amount of interest in this field, but perhaps the editor couldn't find the appropriate papers for the book he had in mind.

From the introduction, I learned that the intended readership includes composers (an important readership, it seems), performing musicians, media artists, scientists, students, scholars, researchers, educators, musical engineers, software developers, entrepreneurs and audiences. This is an ambitious list. Indeed, I am curious to know whether readers of "Computer Music Journal," already an easy-to-access medium, would be interested in buying this book. Without these loyal customers, potential buyers will consist mainly of libraries and newcomers to the field.

Given the affordable price (\$25), it is, after all, handy to finally have all these articles neatly bound together in a book, organized in sub-topics, overviewed individually by Mr. Roads and, last but not least, indexed by subject and name. For newcomers to the field, this book is indeed useful, as it contains quite a few tutorials and introductions on such subjects as synthesis techniques, probability distributions ("stochastic canons") and their applications, MIDI (musical instrument digital interface) and microprocessors, music software, the MIDI standard and digital filters. As a relative newcomer to the field myself, I am always surprised to see that certain articles can be immediately of use because I am continually approaching the field from different angles. I have found myself checking older issues of "Computer Music Journal" time after time. MIT Press must have figured that this is a quick way of getting out a sort of handbook on computer music.

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< BOOK REVIEW: The Digital Word: Text-Based Computing in the Humanities >

Edited by George P. Landow and Paul Delany, MIT Press, Cambridge, MA, 1993. ISBN: 0-262-12176-X.

Reviewed by Richard Ross, Interactive Arts, Gwent College of Higher Education, Wales, NP61XJ. E-mail: rross@gwent.ac.uk

"The Digital Word" continues Landow and Delaney's exploration of new tools in the humanities (for "humanists"). Their previous collection, "Hypermedia and Literary Studies," examined the

use of hypertext and hypermedia to free up the internal structure of the text. This new book covers a rather broader area, ranging from the global electronic distribution of literary works (for instance, by the international Text Encoding Initiative [TEI]) and the electronic global forum of debate and exchange among humanist scholars (electronic mail and conferencing) to computer assisted literary research and text management (mainly markup systems).

A good half of the contributors are Professors of English or Literature, two thirds have worked developing software for use in these areas and one is described rather mysteriously as someone who works for the United States government but enjoys writing programs to help people in his spare time. Much of the software mentioned in the articles is free and details on how to obtain it are provided, although this may require electronic access ("One is either on the net or off the net" is now an ontological statement.) The e-mail addresses for all the contributors are also listed.

Two thirds of the essays focus on specific projects. In reading the entire volume, one learns of the lexicographer's job (in "The British National Corpus" by Jeremy Clear), the French government project to establish an electronic library ("Reading and Managing Texts on the Bibliotheque de France Station," by Jacques Virbel) and the advantages of using standard generalized markup language (SGML) to make electronic writing transportable (two essays by James Coombs, Allen Renear and Steven DeRose). There are also articles on text management in general (searching, organizing, coding, sorting, counting and concordancing) and a section on textual resources and scholarly communication (academic conferencing through the Internet and the use of some Internet tools to search for and grab texts).

The two essays most directly related to literary research are Ian Lancashire's critical analysis of Margaret Atwood's novel "The Handmaid's Tale" and Peter Robinson's research into critical editions and primary manuscripts. Lancashire used software programs to analyse word frequencies, concordances and conjunctions in order to discover features of the text that had not been observed previously. For example, he found that Atwood seems to use the focal points of hands, heads, faces and eyes in relation to gender as part of the central core of her novel. Robinson's essay describes the results of his use of software for regularisation and collation, making relations between old Norse manuscripts transparent. He also borrowed techniques from evolutionary biology (cladistic analysis) for the reconstruction of the descent of related species. With the help of a software package, he placed 46 manuscripts into an evolutionary tree. From external evidence he knew the relations between 15 of them and these relations were reflected in the generated tree.

Both of these writers stress that these techniques are no substitute for actual interpretation. However, as in any area of research, new tools and new methodologies may shed new light on an area. This use is analogous to archeologists' use of aerial photography to pick out unusual forms in a landscape (which may or may not have any significance, but may have been foregrounded in the Prague Structuralist sense) instead of relying on their trowels and a familiarity with the subject material. The interpretation of aerial photographs is now part of the practice of archeology.

Three of the essays theorize about the Internet in various ways. These are by Renear and Bilder ("Two Theses about the New Scholarly Communication"), Kaplan and Moulthrop ("Seeing through the Interface: Computers and the Future of Composition") and Landow ("Electronic Conferences and Samisdat Textuality: The Example of Technoculture"). The first is typical of much writing on new technology in that it fails to acknowledge that what will happen in the future is not determined purely by the potential of technology (technological determinism abounds in this collection). It must be recognized that technology is, to a certain extent, socially constructed. In the context of the humanities, the technologies that will find a place there are largely going to be those that connect to current practices and are thus "acceptable" to humanists engaged in current humanist projects. As Mark Olsen has recently pointed out, three decades of literary computing have failed to have any impact on literary criticism and scholarship and its results are rarely cited outside of the computing community. Computers are more likely to enter this area when humanistic rhetoric about its own projects and practices begins to change. Put simply and crudely, most workers in the humanities might be described as "behind the times."

Kaplan and Moulthrop redress the balance somewhat, beginning with a quote: "The way we see things is effected by what we know or what we believe." The potential effects of new media are recognized. They urge that "rhetoricians and communications theorists should certainly be enfranchised in the decision making about what sort of mirror realities to build." They are concerned about the lack of recognition and acceptance of hypermedia as an object worthy of literary discourse. They examine the knowledge structures revealed in this "topographic and potentially interactive writing . . . . Always open to interventions and new arrangements and relationships, such texts require us to rethink what we mean by "text", suggesting that what we mean is less an object than an articulated social practice . . . . In our study of this emerging rhetoric of machine-mediated communication we need to reveal (or invent) ways in which a technological culture can envisage and revision the multitude of messages it produces. Our project calls for culturally and historically situated research encompassing both textual theory and practice."

Likewise, Landow examines the nature of these new textualities and the status of writing in electronic space. He uses his experience of "Technoculture," an electronic conference, as a case study. This is particularly interesting, as it captures the feel of "being in" an electronic conference debating these very matters through its use of quotes.

The main problem with any book on this subject is that it is barely published before it is dated. For example, the Internet navigational tools such as Gopher and WAIS are described; however, World-Wide Web (which allows one to use the Internet as a hypertext) has been around since 1992 and is not mentioned. This must be particularly galling for Delaney and Landow, who have a particular interest in hypertext. However, this is obviously a problem that is inherent. In all, the book may be categorized as a very wide-ranging collection of highly specialized articles that are probably only of interest to those whose work brushes against one of the constituent articles.

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< COMPUTER SOFTWARE REVIEW: Fractals for the Macintosh/Mandella v8.71 >  
by Jesse Jones, 200 Tamal Plaza, Corte Madera, CA 94925.  
Waite Group Press, 1993. \$24.95

Reviewed by Geoff Gaines, Space Sciences Laboratory,  
University of California at Berkeley, Berkeley, CA 94720  
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#### Introduction

One of the interesting qualities of fractals is that they grow from a seemingly incongruous union of organic beauty and abstract mathematics. The aesthetics of fractals is of interest to artists and mathematicians alike, for the its relevance to the chaos theory (which studies behavior patterns of various unstable systems, ranging from weather and population growth to fractals). It has been the challenge of publications and software to meet the diverse interests of both groups. Mandella and "Fractals for the Macintosh" together achieve this goal, forming a powerful combination which opens vivid fractal worlds to all.

#### Ease of Experimentation

Generating fractals entails a great deal of experimentation with different factors, such as coordinates, escape times, cutoffs, and draw styles. Indeed, the unlimited combination of parameters can be truly daunting. In addition, a complete image can take hours to generate. In the past, generating a fractal required patience and dedication, not unlike that of a fine brew master, who takes great care to record the amounts of each ingredient, refining a recipe over a period of months, until finally tasting the finished batch. Fortunately, computer speeds have accelerated enough to bring high resolution fractals to our desktops. But uncovering the beauty in an abstract table of numbers still requires a good deal of control and experimentation.

Mandella was written with this need for experimentation in mind. When you open the program, a preset window with all of the available fractal families gets you right to the goodies. New presets can be saved as you discover uncharted terrain. Unlike other popular fractal programs, you cannot enter your own fractal formulas, but with the range and flexibility of the available presets, this is not a serious setback. Piloting around a complex plane is streamlined by Mandella's scroll, zoom, and center commands. This multiple-pass drawing method lets you see the whole fractal in low resolution right away so you don't have to wait half an hour to find that you have sheared off part of your image. Fine adjustment of the frame and zoom can be accomplished in minutes, rather than hours. Line-by-line and one-pass methods are also provided. Multiple windows greatly reduce the experiment cycle by letting you compare fractals side-by-side. Color adjustments can be seen as you make them. After about an hour of getting myself familiar with the commands, I was quickly generating gorgeous fractals. At last! A fractal program that allows for exploring, rather than arduously fishing!

#### Impatient?

Mandella also does a great deal to reduce the familiar tedium of long generation times. All of the program's functions can be accessed while the fractal is still drawing, enabling you to noodle with the color as it goes. Better still, fractals can be drawn in the background, and the processing time devoted to the task can be adjusted. (I'm running a Julia set as I write this.) A nice detail is a vertical bar in the fractal window which graphically indicates the draw progress. This prevents a lot of impatient squinting at multiple pass fractals. For your big full-screen run, you can set up Mandella to draw and save multiple images overnight. It would be nice if fractals did

not need to be fully redrawn when you change the center, or zoom out. Overall, Mandella respects the fact that your time is valuable, and goes out of its way not to waste it.

#### Draw Styles

Mandella has numerous draw styles, (as distinct from draw methods), which give the user more control over how the fractal is presented. In its raw form, a fractal is a table of "dwells", or rates at which the generating function diverges to infinity, (Technically, this is only one of the fractal families called "escape-time" fractals). The draw method selects the way in which the program converts these and associated numbers into colors. The most common method is to break the color palette down into a range of numbers and assign them directly to the dwells. Mandella provides eleven different escape fractal draw styles, each of which profoundly alter the appearance of the fractal.

#### Color

After you've framed and drawn a fractal, there's still much more you can do. A powerful palette editor gives the fractal designer access to all of the colors of the Macintosh. Colors may be smoothed together, alternated, or interleaved. Specific color values can be edited either directly on the palette or on the fractal itself. A color map window lets you adjust how the palette is mapped to the dwell values on the fractal. Without this feature, a flat background might display only a sliver of the palette, using most of the range on the complex features of the fractal. Another nice feature is the "animate" option, which cycles through the palette, making the image spin and bubble with color.

#### 3D Transforms and more

Mandella provides a variety of convolutions and transforms to perform on the finished image. As with the draw styles, these functions work with the dwells of the fractal. But, unlike the draw styles, convolutions alter the dwells by averaging neighboring fractals together, or by enhancing edges. For example, the Sobel convolution enhances colors which change rapidly in a particular direction, giving the image a textured, pseudo-3D effect. (This is my favorite convolution.)

The transforms function manipulates dwells to create a completely new image. For example, the 3D transform will turn your fractal into a rugged landscape at sunrise. A dialog box lets you select the viewing angle, sun height, and the steepness of the slopes, (gradient). There are about 15 transforms and convolutions in all.

#### It Moves!

The best I saved for last. If you have ever generated a fractal, it probably wasn't long before you yearned to animate them. Even with a fast enough machine, registering frames and zoom amounts can be a nightmare. Pre-Mandella, I would often end up with a short jerky movie that was likely to shoot straight into a black hole. Even on decent runs, the colors would rescale for each frame, making the experience more psychedelic than the cruise through Mandelspace I'd anticipated.

Mandella provides an automate feature which generates a series of frames, greatly simplifying the process of making a movie. In addition to automating a zoom, you may choose to vary a fractal constant, making your fractal evolve and grow. You can also use the automate feature to randomize the fractal constants or to enlarge your image for fractals bigger than your computer can normally handle. Unfortunately zooms must begin with one of the preset fractals, and I wasn't able to start from a customized preset. Nonetheless, I have put together some stunning animations in little more than the time it took to render the images.

"Fractals for the Macintosh"

"Fractals for the Macintosh" was written by Jesse Jones, the creator of Mandella, and I found it a fine companion to the software (Mandella is bundled with the book). I would highly recommend perusing the book if you are interested in the program. Of course, you do not need the book to create beautiful images, but there are many things which would be difficult to learn by chance. For example, there are a large number of useful keyboard shortcuts which are not displayed in the software. Most importantly, the book gives the user a leg-up on effective parameter, draw style, and transform combinations. For instance, what is the best draw style for movies? Or for the 3D transform? What slope and bailout should you choose for continuous potential draw style? What is the kernel editor, and how does it work? My fractals improved tremendously after reading the book, as did my enjoyment.

Summary

In reading books on fractals and chaos I have always longed to play with the parameters myself. To satisfy this, I've written and obtained software to generate fractals. But there's always been a gap between the books and the software I could never quite close. The images in books and magazines always made a mockery of my home-brew fractals. On the other hand, the software demanded a great deal of time-consuming experimentation with parameter ranges that the theory in the books could not address.

"Fractals for the Macintosh" gives clear and concise explanations of the theory, as well as software and parameter specifics. Even better, the photos in the book are inspiring, but are in black and white, so they can't compete with your own color fractals! Mandella turns experiment into exploration, and produces stunning fractals and fractal movies. The combination of Mandella and "Fractals for the Macintosh" succeeds in bridging the gap in style.

Mandella requires a Macintosh with System 6.0 or later. Certain transforms require a math coprocessor.

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< AUDIO COMPACT DISC REVIEW: Venturi Shadows >

Robert Dick

(Running Time: 50:07)

O.O. Discs, 502 Anton St., Bridgeport, CT 06606-2121 USA

Reviewed by Jason D. Vantomme, Music Technology Area, Faculty of Music, McGill University, Montreal, PQ CANADA

Robert Dick has earned a respected position not only in the flute playing community, as an expert and innovator of extended techniques, but also as a respected composer and performer in the field of contemporary music. Indeed, such regard is apparent when one listens to Dick's disc "Venturi Shadows". Joining Robert Dick in this recording's performances are Mary Fink, Steve Gorn, Neil Rolnick and Ned Rothenberg; with the exception of "Bassbamboo" all works are composed solely by Dick.

The disc's first track "A Black Lake with a Blue Boat on it" (on which Rolnick manipulates live electronics and samplers) requires not only a regular C flute, but also an unusual A-flat piccolo. The clever interplay between the electronic and acoustic mediums becomes, as Dick says in his liner notes, "a magnified flute with a magnified, cubist personality..."

The second and third tracks, "Further Down" and "Heart of Light" are both pieces for solo flutes, again the A-flat piccolo. Here, Dick provides the listener with a tremendous display of the instrument's timbral abilities. Not only can the A-flat piccolo play the typical piccolo role at the "top of the orchestra", but it also possesses a middle and lower register that is dramatically darker than the crisp piccolo in C; it is this character that

truly stands out in "Heart of Light".

"Bassbamboo", a co-composition with Steve Gorn for bass flute and bansuri, begins with a bansuri accompanied by a percussive bass flute that eventually emerges to the foreground. Though the bansuri regains the lead, with the bass flute setting a subtle rhythm, the work ends with both instruments on equal footing, in unison.

Of notable mention on this disc is Dick's work, "Recombinant Landscapes" for two flutes, here recorded with Mary K. Fink. This work, above all the others, seems to have achieved a sonic environment so rich and complex that it is difficult to believe that the players are not actually accompanied by a tape. Both players work closely as one "synthesis device"; what emerges are timbres normally only associated with electro-acoustic composition. This makes for an impressive recording.

Following the solo work "Venturi Shadows" and the duo work "Daytime" (with Ned Rothenberg on shakahuchi) is the disc's final work, "Times". Like the disc's first track, "Times" involves a prerecorded element. It is not clear from the liner notes whether or not the entire work is solely a tape work, or is performed by a live soloist, with taped tracks overlaid. Either way, Dick captures a wide range of expressions with multi-tracked bass flutes, Mexican double ocarinas, flutes and piccolos, and prepared flutes, all presented in their own unique section.

"Venturi Shadows" is a successful compilation, displaying Robert Dick's technical prowess and musical competence. He has a unique ability to transform a traditional acoustic instrument into a source of dramatically varying timbral possibilities--a definite asset to any contemporary music collection.

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< AUDIO COMPACT DISC REVIEW: Contemporary Flute Music >

Pierre-Yves Artaud

(Works by Mefano, Varese, Korde, Mabry and Cage. Running Time: 59:09)

Neuma Records, 71 Maple Street, Acton, MA 01720 USA

Reviewed by Jason D. Vantomme, Music Technology Area, Faculty of Music, McGill University, Montreal, PQ CANADA

Beginning Pierre-Yves Artaud's disc entitled "Contemporary Flute Music" is the intense work "Traits Suspendus" by French composer Paul Mefano. What makes this opening piece fascinating is its scoring for the uncommon, and certainly remarkable, contrabass flute. The two-section work begins with a rapid and harsh, yet highly rhythmic, sequence of pitches performed between overtones on the flute. The resonance of the large bore of the contrabass provides the additional feeling of listening to the instrument through a large pipe. A diminished, second section is completed with a heavy, less refined recapitulation of the work's opening material.

The second work on Artaud's disc is the now classic "Density 21.5" by Edgare Varese. The inclusion of this work seems symptomatic of ultra-conservative contemporary music trends, in that the piece is over 50 years old and is still considered "contemporary"; Varese composed the work for Georges Barrere in 1936. Additionally peculiar is the decision to place the track of "Density 21.5" immediately following "Traits Suspendus". The driving force of Mefano's writing completely overwhelms the brief "Density 21.5" and as a result, Varese's work loses any intended impact.

On the other hand, the choice to include Shirish Korde's "Goldbach's Conjecture" for C flute and tape was an extremely wise decision: Artaud's performance style is clearly suited to this work. Like Mefano's opening piece, "Goldbach's Conjecture" is comprised of two clearly identifiable

sections. The first of these is the delivery of a widely arranged set of pitches at widely varying speeds. The second section introduces computer-generated tape material, whose primary role is to provide a complimentary reverberance to the live performer. With the combination of a well-constructed tape and the careful musical attention of the performer, the duo often becomes perceptibly indivisible.

Drake Mabry's "5.4.88" for amplified C flute demands many extended techniques from the performer, all of which are handled with complete adeptness by Pierre-Yves Artaud. These include whistle-tone passages, key slaps, tongue rams, and several others. Unfortunately, the short-term interest in presenting these effects seems to detract from any possible appreciation of the work's central meaning.

Completing the disc is John Cage's "Ryoanji", on which Artaud is joined by the percussionist Jean-Charles Francois. As with "Traits Suspendus", the listener is exposed to another oddity in the flute family, this time in the form of an octobass flute (co-created by Artaud and flute maker Jean-Yves Roosen). Inspired by the Zen meditation at the Japanese Temple of Ryoan-ji, Cage's work simultaneously demands patience and openness to the environment, expressed by washing flute textures and an unpredictable drum beat.

Though the individual pieces on "Contemporary Flute Music" are enjoyable and in some cases quite impressive, it is difficult to understand the programming choices made by Artaud and the producer; perhaps more consideration in these matters may have made the disc more successful.

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< BOOK REVIEW: Hand and Mind: What Gestures Reveal About Thought >  
by David McNeill, University of Chicago Press, Chicago and London 1992.  
416 pp. ISBN 0-226-56132-1.

Reviewed by Rudolf Arnheim, 1200 Earhart Road, #537, Ann Arbor,  
Michigan, 48105.

David McNeill's book is a momentous contribution to our understanding of kinetic and visual expression. It deals specifically with the interrelation of gestures and speech -- a sensible and necessary limitation, given the wealth of experimental evidence and theoretical discussion McNeill has to offer. This does not keep the book from being an invaluable source for anybody interested in expression more in general. Expression, of course, goes beyond gestures as a component of speech. It involves all bodily movements, such as practical action as well as gestures. The human body expresses itself in the way people operate machines, reach for tools, or handle a patient. Without speech, the mind symbolizes its attitudes and stirrings in the dance and pantomime and in the visual images of the arts. All this amounts to a huge subject, well beyond a single scientific undertaking.

By focusing on the interaction of gesture and speech, the author, a professor linguistics and psychology at the University of Chicago, launches a frontal attack against the dominance of verbal language, which has crippled much dealing with cognition in our time. He shows how speech relies everywhere on gestures in order to enlist the help of imagery and thereby to make up a main deficiency of the verbal medium. He shows experimentally that gesture, far from being a mere accompaniment of language, precedes it, because gestures depict images directly, and all thought begins as imagery. Imagery, the root of thought, expresses itself directly in the kinetic and visual medium of gesture. Secondarily, the mind gropes for words to account for



the iconic experience. "Often have I regretted," writes McNeill, "not having video equipment with me at the talks of colleagues who so firmly believe that words, phrases and sentences are the only substantive parts of language" (p. 149). Their ample gestures refuted the dogma they were defending.

Speech confines the expression of the human body mainly to the action of the hands and arms, our most articulate limbs. Gestures of the legs would be much poorer. By the same token, speech impoverishes the eloquence of the body, as the addition of talk to the silent cinema has so painfully demonstrated. Like the hands of the Hindu dancers, our gestures make the most of this limitation. Since gestures are actions, they are most effective in depicting motion. McNeill shows that we do so in two ways. Sometimes the speaker's own body acts out the story he or she is telling. But just as often the story is performed by the speaker as a detached puppet play in front of the body.

McNeill describes the basic difference between iconic and metaphoric gestures. Iconic gestures portray their physical counterparts, the way somebody or something behaves in space or the way they are shaped. Metaphoric gestures make abstractions concrete by using their symbolical analogy of physical qualities. Extended arms express the hugeness of a problem, wriggling motions depict confusion. McNeill's detailed descriptions of how gestures represent ideas contribute greatly to our understanding of images as the carriers of abstractions.

Both images and gestures can be analogical or digital. Unrestrained and spontaneous, our limbs move in space, doing their work and depicting things and ideas. In such analogical fashion they are "global and synthetic" and thereby congenial to images, when images also require no conceptual abstraction. Both media of cognition, however, can freeze into digitally defined concepts and thereby make languages possible. Languages can be gestural, aural, pictorial, or verbal. The gestural communications of the deaf are coded sign languages; and McNeill in a delightful chapter describes the standardized gestural signs of different languages. The sounds of music are an aural language, geometrical symbols are a pictorial language, and words are verbal languages.

We are reminded that all cognition starts with imagery, whose most concordant manifestations are gesture and pictures. These kinetic and visual expressions can congeal into concepts, and they in turn give rise to the equally digital medium of verbal language. Significantly, McNeill's technical problem in writing his book is how to describe gestures in words, with the help of drawings. He masters this task in a most enjoyable and scientifically impressive manner.

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< BOOK REVIEW: To Infinity and Beyond; A Cultural History of the Infinite >

by Eli Maor. Princeton Univ. Press, 41 William Street, Princeton, NJ 08540, U.S.A., 1991. \$16.95. ISBN 0-69-02511-8. Originally published in 1987 by Birkhauser Boston.

Reviewed by Roger F. Malina, 95 Hiller Drive, Oakland, CA 94618, U.S.A.

I was pleased to find in an airport bookstore a copy of Eli Maor's book, "To Infinity and Beyond, a Cultural History of the

Infinite," which originally appeared in 1987 and was reprinted in 1991 by Princeton University Press. Since a house fire destroyed my library, I have been slowly re-acquiring important books in the field of art and science. Maor's book was one that I was keen to own again. In rereading it, however, I was struck by how exciting the field of art and mathematics has been in the last 10 years, and how Maor's book now seems in need of updating.

"To Infinity and Beyond" is primarily a selective history of number theory and ideas connected to the concept of infinity. Part One, "Mathematical Infinity," covers concepts in number theory, number series, prime and irrational numbers, and closes with sections on Cantor. Part Two treats geometric ideas, map concepts, the tiling of the plane, and non-Euclidean geometry.

Part Three, "The Aesthetic Infinity," consists primarily of chapters on the Mobius Strip, the work of Escher, and a discussion of the Kabbalist and Christian concepts of God. The final section, "Cosmological Infinity," discusses astronomers' evolving concepts of the size and structure of the universe.

Maor writes authoritatively and compellingly, particularly in the sections dealing with mathematics. However, he fails to deliver the topic indicated by the subtitle of his book, "A Cultural History of the Infinite." The sections of the book dealing directly with mathematics fail to discuss the cultural or social context in which these ideas evolved (apart from inadequate biographical information about the mathematicians mentioned). Today, as we see the direction of scientific research change with the societal consequences of the end of the cold war, one is prompted to ask about the cultural context of Cantor or Mobius [1]. A discussion of the idea of progress, the Industrial Revolution and other theories of history would seem apropos in a discussion of nineteenth-century mathematics for instance. Ironically, Maor's book treats mathematics as almost "outside" culture rather than discussing the idea of infinity as embedded in a context in which art, science, and technology are all elements of culture.

Written in the early 1980s, the book highlights the exciting developments that had occurred in art and mathematics in the previous decade. The book privileges the work of Escher. (All the color plates are of Escher's work -- do no other artists deserve similar attention?) There is no discussion of the impact of computers on geometry or number theory. Fractals are relegated to a footnote, Penrose and quasicrystals are barely mentioned in the discussion of tiling of the plane, the discussion of cosmology makes no mention of inflationing universe or missing matter and the impact of virtual reality and hypermedia on ideas of the structure of infinite spaces is not even addressed. The fact that these omissions now appear as shortcomings is testimony to the explosion of new ideas linking art and mathematics. In spite of this, Maor's book is to be highly recommended for its clear exposition and fresh views on the way that the human mind makes sense of the world through the use of number and mathematical relations.

#### Reference

1. For more on the cultural context of Mobius, see Fauvel, Flood and Wilson, eds., "Mobius and His Band: Mathematics and Astronomy in Nineteenth Century Germany" (Oxford, United Kingdom: Oxford Univ. Press, 1993).

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|SPACE ARTS NEWS|  
| MAY 1994 |  
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Editor: Roger F Malina Editorial mail to: davinci@uclink.berkeley.edu  
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Space Arts News (SAN) is an occasional publication of the International Society for the Arts Sciences and Technology. Publication of SAN is co-sponsored by the Subcommittee on the Arts and Literature of the International Academy of Astronautics ( IAA 6 Rue Galilee PO Box 1268-16, Paris Cedex 16, France).

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< IAA SYMPOSIUM: IMPACT OF THE SPACE AGE ON OUR CULTURE >

The IAA is holding a symposium on The Impact of the Space Age on our Culture at the International Astronautical Congress to be held

in Jerusalem, Israel during October 1994. Papers that will be presented at the Symposium include:

Harvey Meyerson: Public Places for the Space Age

Arthur Woods: The role of art in communicating the importance of space activities.

Mark Williamson: Space Age Images- Part of our Culture

V. Koshelev: Space Investigations and Modern Religious Consciousness

Richard Kriesche: Satellite Art

Alan Marshall: Space and Environmentalism -

Herve Moulin: Space Activities and the Press

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< CONFERENCE ON INSPIRATION OF ASTRONOMICAL PHENOMENA: THE EFFECT OF ASTRONOMICAL PHENOMENA ON LITERATURE, ART, MYTH and HISTORY >

This historic international conference will be held at the Vatican Observatory from June 27 to July 2 1994. By special arrangement with the conference organisers we will be publishing in this issue, and forthcoming issues, of Space Arts News the Abstracts of all the papers which will be presented at the conference. We thank Professor Raymond E. White, member of the conference International Organising Committee, for arranging for the publication of these Abstracts in Space Arts News. Readers interested in details on the conference should contact the Conference Chairman (contact information given below). Attendance is by invitation only -total attendance is limited.

Conference Details:

Chairman: Dr. George V. Coyne, S.J., Director, The Vatican Observatory, Castel Gandolfo, V-00120 The Vatican State.

Telephone: 39-6-698 5266 Fax: 39-6-698 4671

Vice-Chairman: Prof. Giuseppe Tanzella-Nitti

#### Introduction

The Conference will be held from Monday evening, June 27, through Noon on Saturday, July 2, 1994. One day (June 29) will be spent on a tour of the Vatican Museum and Library. The Conference will be held mostly at the Villa Mondo Migliore, close to the Vatican Observatory at Castel Gandolfo (which in turn is part of the Vatican State), and partly at the Observatory (both sites are high in the Albani Hills, overlooking Lake Albano, about 35 kilometers southeast of Rome). This affords an isolated location that will encourage collegiality at the meeting, while still being convenient to Rome and all major transportation.

#### Synopsis

We will hold an International Conference to discuss the effect of astronomical phenomena on human thought and activity, and to explore how these phenomena have affected mankind's view both of itself and of the cosmos. The Conference will study the cultural significance of these universal phenomena, as distinct from the immediate physical effects of light and dark, or heat and cold.

We find our evidence in the archaeological, anthropological, artistic, historic, and literary records, and look for parallels and divergences in these records throughout prehistory and history. Scientific studies of astronomical phenomena will be included only insofar as they influence a broader cultural context.

The time is ripe for such a Conference. The present studies in this general area tend to be fragmented and specialized, with little interdisciplinary activity. Meetings are usually focused on particular aspects of culture like archeoastronomy or ethnoastronomy, or on the history of science. This would be the first meeting to study the impact of astronomical phenomena on such a wide range of human thought and activity throughout history.

The International Organizing Committee includes:

- George V. Coyne, S.J./The Vatican Observatory
- Martin Harwit/The Smithsonian Institution
- Andrzej Pacholczyk/The University of Arizona
- Rolf M. Sinclair/U.S. National Science Foundation
- Raymond E. White/The University of Arizona

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< SELECTED ABSTRACTS >

< The Impact of the Qur'anic Conception of Astronomical Phenomena on Islamic Civilization >

Imad Aldean Ahmad, Imad-ad-Dean, Inc. 4323 Rosedale Avenue  
Bethesda, MD 20814 USA

The Qur'an places a strong emphasis on natural phenomena, especially astronomical phenomena, as Signs of God. We analyze the meaning of the term in the Qur'anic context and its impact on the Islamic Classical Civilization (622-1492). We explore how differences between medieval Islamic culture and medieval European culture may be related to the influence of this Qur'anic conception. Among the factors are: the empirical element in science, the scientific nature of legal scholarship, egalitarianism and pluralism in the political system. We note the congruency between the attitude of Islamic scientists towards astronomical studies and the attitude of Al-Ghazali towards religious matters. We propose that the conception under study accounts for the seeming indifference of the Muslim civilization to the heliocentric vs. geocentric debate compared to its revolutionary impact on Europe.

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< COWS & STARS: ANTECEDENTS TO SOLAR KINGSHIP IN ANCIENT EGYPT >

Fekri A. Hassan, Department of Anthropology, Washington State University  
Pullman, Washington 99164-4910

The Egyptian pharaoh, among other things, was regarded as a representation of Re -- the sun god. Re belongs to a solar cosmogony that became prevalent during the Old Kingdom. However, Re was inexorably associated with divine cows. For example, Nut, a cow sky-goddess was his mother. Hathor, a fertility, nurture, and protection cow-goddess was his daughter and wife. Cows & Stars presents a model that places symbolic integration and syncretism in earliest Egypt within the context of economic, social, and political changes. The cow emerged as a deity of nurture and life-sustenance during the Neolithic in the Sahara

(=> 6000 BC). She represented a common primeval divine type for the early farming communities on the banks of the Nile.

During the Predynastic period (ca. 5000 to 3000 BC), agricultural communities in the Nile Valley and the Delta developed political systems that became increasingly complex through time. By 3300 BC, several provincial states with local deities and totems became powerful political centers. Horus, a falcon deity (or later a deified totem) became widely adopted by several states as a symbol of kingship (not unlike the lion which is still today a symbol of royalty).

During the Old kingdom, a unification of provincial kingdoms into a nation-state was accompanied by the emergence of a royal ideology that considered Re (a creator god) as husband of Hathor, and of Hathor as the mother of Horus. The king, as Horus, thus descended both from the primeval goddess and the son of the creator. Later political upheavals led to a reformulation of this religious legitimization of kingship.

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< LIFE IN THE UNIVERSE: A HUMANISTIC VIEW? >

Chris Impey, University of Arizona

Either humans are alone as sentient observers of the universe, or they are not. The implications of both possibilities are profound. The past 400 years has seen a dizzying progression which has displaced the Earth from the cozy center of the universe to a small chunk of rock orbiting an average star among 100 billion in the Milky Way, which is one of billions of galaxies adrift in a vast and inhospitable cosmos. Science is starting to address some of the issues of life in the universe. Astronomical techniques are capable of detecting large planets around nearby stars. The theory of planet formation is being refined. Some of the biochemical processes involved in the development of life on Earth are now understood. The search for extraterrestrial intelligence (SETI) has begun, using radio and optical telescopes.

By contrast, the cultural context for the search for life in the universe has received little attention. This paper considers the evolution of human thinking on our place in the universe, from the ancient Greeks to the present day. A distinction is drawn between arguments that are scientifically testable, those that are merely plausible, and those that are unduly anthropocentric. This includes a critique of the anthropic principle. The possibility of life in the universe beyond the Earth has contributed to the tension between science and religion. In modern times, the SETI activity has had a strong impact on popular culture, as seen through literature, films and television. The political and ethical consequences of making contact will also be considered.

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< ASTRONOMICAL ART, ASTRONOMY AND ASTRONAUTICS: A SYMBIOTIC RELATIONSHIP >

Ron Miller, 5210 Potomac Creek Road, King George, Virginia 22485, USA

Although many scientific disciplines have related art forms -- most notably medicine and paleontology -- only in the case of astronautics did the art preexist the science. Indeed, art (both in the form of visual arts and literature) was instrumental in the creation of astronautics. The first true astronomical art were the illustrations produced for Jules Verne's 1865 novel "De la Terre la Lune" (in which, incidentally, the science of astronautics was introduced). Two

distinct branches of space-related art sprung from this beginning: art related to how humans will explore space (often referred to as "hardware art"), and art related to what we will find there (usually referred to as "astronomical art").

Enthusiasm for this sort of art and literature was fanned by the widespread and passionate enthusiasm that the 19th century had for science, engineering and discovery. In turn, art and literature of this kind was instrumental in not only disseminating this knowledge but in symbiotically maintaining and increasing public interest in science and technology.

Never before the time of Verne's novel had there ever been any attempt to realistically depict scenes set outside the earth, nor any attempt to realistically depict a spacecraft. In turn, this novel set an unprecedented standard for realism and scientific verisimilitude for other novels about spaceflight, which, by the end of the 19th century, had become enormously popular. Indeed, the idea that spaceflight was a given accomplishment of the not-entirely-distant future was a fully accepted concept by the turn of the century. In the first decades of the 20th century artists appeared who were able to specialize in depicting scenes of spaceflight and/or other worlds. Perhaps the first such was British illustrator Scriven Bolton. This type of art was perfected by French artist-astronomer Lucien Rudaux and brought to a high polish by American Chesley Bonestell. Just as Verne's novel had directly inspired most of the seminal pioneers of spaceflight (such as Oberth, Tsander, Tsiolkovsky, Goddard and many others), Bonestell's art directly inspired many of the scientists and engineers - and particularly the politicians -- who launched the first spaceships.

While space art depends a great deal upon space scientists for information concerning the subjects it depicts (to the space artist the astronomer acts only as a surrogate pair of eyes), in no way do space artists consider themselves as "mere" illustrators, or in any way subservient to scientists. They consider it their right and perhaps even their obligation to carry things just a step or two further beyond what may strictly be known, to add something of their own beyond the mere delineation of hard fact. And it is just this strong vein of Romanticism (linking space art not with other modern genres, but rather with the 19th century Preraphaelites and Hudson River School) that provides the all-important feedback.

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< THE INFLUENCE OF ASTRONOMY ON ISLAMIC MUSIC >

Jozef Pacholczyk, University of Maryland, Baltimore County

The problem of the relationship of music and astronomy can only be understood in the context of the Islamic culture, its philosophy, science and art. Islamic art is deeply symbolic. The symbols are used to explain the un-explainable. The symbols were shared by the arts as well as by various branches of learning, such as mathematics, alchemy, geometry and astronomy.

The symbolism in Islam developed under the stimulus of the Pythagoreans and neo-Pythagoreans whose works, together with the works of other Greek writers were translated into Arabic, especially during the Abbasid period (750-1258 A.D.). It impregnated all branches of learning and can be considered as one of their unifying elements. The symbolism of numbers, geometrical figures, and astronomical concepts was applied to the architecture, poetry, painting, musical instruments and structure of musical pieces. It is best explained in the treatise of Ikhwan as-Saf' (Brotherhood of

Purity, tenth century A.D.). Numerous theoretical treatises on music by such writers as Mub rak Sh h (1275 A.D.), Abdu' l-Q dir Mar gh (1350-1435 A.D.), L dhiq (sixteenth century A.D.), and others identify musical modes (maq m-s) with Zodiac constellations and assign them the therapeutical properties. This kind of theoretical treatises continue to be written until the present day, especially on the peripheries of the Islamic world.

Some of the main symbols, such as a spiral, representing a cosmic mandala, that is evident in other forms of art such as in the shape of the minarets, organization of figure in the miniature paintings, geometrical designs of carpets, have been identified in the structure of music, for example in the structure of the specific parts of the Uzbek shashmaqam, in the Alevi music of Turkey and in the pattern of acceleration in the suites (mag m) in many parts of the Islamic world. The association of the astronomy and music can also be seen in the rituals of some orders, for example in the sema dance of the Mevlevi-s and in that of the Jerrahi-Halveti-s of Turkey. In these ritual dances the movements of the participants symbolize the movement of celestial bodies.

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< A New Determination of the Birth Year of Jesus Christ >

G.B. BARATTA, Osservatorio Astronomico di Roma

The star of Bethlehem has been usually the starting point for the determination of the birth year of Jesus Christ: but in this way no definitive results have been so far obtained. For this reason, we reexamined the problem, rediscussed the historical testimonies, and found a very good date for the birth of Jesus Christ in the period 12-11 B.C. Such period is also in very good agreement with the appearance of a very exceptional astronomical object, Haley' s Comet.

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< Other Worlds: The Cultural Significance of the Extraterrestrial Life Debate >

Steven J. Dick, U.S. Naval Observatory

The belief in extraterrestrial life has been one of the most pervasive influences of astronomy. On the most general level, the widespread belief in extraterrestrials constitutes a non-anthropocentric world view - here termed the "biological universe" or the "biophysical cosmology" - which has been as influential among some as the more scientifically reputable purely physical cosmologies. Although still unverified, this world view has had a significant impact on many aspects of culture.

Since the dawn of Western science in ancient Greece, extraterrestrial life has been a persistent theme of natural philosophy, culminating in the 20th century with the Viking landers on Mars, the search for planetary systems, and SETI. Beginning with H. G. Wells' War of the Worlds (1897), it has been a major theme in the literature of science fiction, and the subject of some of the most popular films in cinematic history. One of its most surprising forms in our century has been the extraterrestrial hypothesis for UFOs. Though its impact on theology has been explored since the 17th century, the idea of extraterrestrials has had little effect on the world' s religions, at least so far.

All of this is but a minor prelude to the cultural impact that would follow the actual discovery of extraterrestrials, a subject first systematically discussed only in the 1990s with a series of NASA-sponsored workshops on "Cultural Aspects of SETI." Such a discovery holds the potential for finding the Holy Grail of terrestrial culture - a truly generalized and "objective knowledge", consisting of



the combined knowledge and wisdom of many intelligent species.

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Additional Abstracts from the conference will be included in the next issues of Space Arts News and will appear in Leonardo Electronic Almanac.

=====END SPACE ARTS NEWS=====

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