

"but let Time's news  
Be known when 'tis  
brought forth"

# Time's News

An  
Aperiodic  
Newsletter

Time's News No 31

*International Society for the Study of Time*

December 2000

## GERALD JAMES WHITROW

*First President of ISST*

1912-2000

*Gerald James Whitrow, first president of ISST, died at the age of 87 on June 2. A service of thanksgiving for his life and work was held on the 27th of September, 2000, at the Holy Trinity Church, Prince Consort Road, London. In addition to family members and numerous friends, present were members of the faculty of the Imperial College of Science, Technology and Medicine, and representatives of the Royal Astronomical Society, British Society for the History of Science, British Society for the History of Mathematics, and of the International Society for the Study of Time. Prof. Donald Lynden-Bell, FRS, paid tribute to Prof. Whitrow for his work in physical cosmology, Dr. J.T.Fraser for his contributions to the study of time and Prof. J. T. Stuart, FRS, for his dedication to and excellence in teaching. Dr. Fraser's tribute follows below.*

I stand here to remember Gerald Whitrow, in words brutally few, for his immense learning and for his intellectual courage in establishing the natural philosophy of time as a scientific and scholarly discipline.

He left us, but his ideas survive. And if one holds, with Wm. Blake, that men are admitted into heaven "because they have cultivated their understanding," then Gerald Whitrow's surviving thoughts will serve not only to maintain his memory, but also to remind us of the human need for a transcendental victory over death.

This is the way our paths first crossed.

In the mid 1950's I began work on a cooperative survey of views of time and was corresponding with a score of scholars and scientists in the USA and in the UK. In 1960 I came upon a paper by Gerald Whitrow in which he compared different theories of gravitation. There was something in the reasoning of that communication which suggested that its author was interested in the nature of time in physical cosmology. I wrote him, asking whether he would contribute a chapter to the survey.

He replied that he would be glad to do so and added that "It happens that I have a book on The Natural Philosophy of Time in the press."

I read the book with an increasing admiration for its author. I realized that it was a pioneering work in distilling of the ideas of classical and modern thinkers and scientists concerning the nature of time.

It also demonstrated that the Heraclitean dictum that "men who love wisdom must be inquirers into very many things indeed," may be followed, on the professional level, even in our epoch. And this is no mean task, because in our epoch the separate islands of knowledge are, so to say, not on speaking terms with each other.

Gerald Whitrow succeeded in establishing a dialogue among many of those islands through his natural philosophy of time, which subsumes understandings derived from the physical, biological, behavioral and social sciences as well as from philosophy.

After 1961 Gerald Whitrow's books, chapters in books, papers, and BBC talks, came to include works focused on the natural philosophy of time. When I revisited his 1949 book on The

Structure and Evolution of the Universe, I had no difficulty identifying his concerns with the nature of time.

In 1966 Professor and Mrs. Whitrow traveled to New York to partake in a conference on "Interdisciplinary Perspectives of Time" at the New York Academy of Sciences. His lecture was entitled, "Reflections on the Natural Philosophy of Time." I spoke on "The Interdisciplinary Study of Time."

At the end of the conference Dr. Whitrow, Dr. Satoshi Watanabe, then teaching quantum theory at Yale and I sequestered ourselves to a quiet corner. I proposed the formation of an international, multidisciplinary professional society with the object of stimulating interest in all problems concerning time. Prof. Whitrow agreed to serve as its first President, Prof. Watanabe as its Treasurer and I agreed to try to get it going.

Since its founding that year, the International Society for the Study of Time has met every three years and published nine volumes in its The Study of Time series. The tenth volume, coming out later this year, is dedicated to the memory of its first President. Through the writings of the members of that Society, Gerald Whitrow's pioneering labor in the natural philosophy of time grew into an extensive, integrated study of time.

In 1969 he gave four talks on the Third Program of the B.B.C. dealing with questions related to the origins of our idea of time and time in the sciences. In 1972, a considerably expanded version of these talks was published under the title, What is Time?

Sixteen years later he published Time in History. It is the most reliable and thorough work of its size, exploring the mutual relations between ideas of history and those of time.

Out of his many writings on time I would like to single out an article to represent the power and clarity of all of them. It is the entry on "Entropy" in the Encyclopedia of Philosophy. It is a small masterpiece of exposition in which he joined his interest in time with his interest in cosmology.

It is appropriate to add here that among those who contributed to the launching of the International Society for the Study of Time, British scholarship and science was richly represented.

But many of those who then joined the exploration "are gone under the hill," to use the words of T. S. Eliot. Those of us who are still around, now give thanks for, and celebrate the life of one who has gone before us.

The study of time is never emotionally neutral because thinking about time is always a reminder of the conflict between our certainty of passage and dreams of eternity.

This conflict becomes overwhelming when a person one loved, dies. When that happens, one becomes face to face with the infinite distance between human reality and the memory of the dead. The words of Yeats then sum up the restlessness of mourning, "The roads are unending," he wrote "and there is no place to my mind."

Indeed, beyond psychology, beyond the DNA and RNA, beyond the field equations and wave equations, there remains a rational mystery, rooted in the incompleteness of nature.

To search for a place of rest in that restless world remains our destiny because we feel lost in the immensity of space.

"Lead kindly light, among the encircling gloom,  
"Lead Thou me on! The night is dark and I am  
far from home."

Likewise, we feel lost and alone in the immensity of cosmic time.

"Abide with me! Fast falls the eventide...."  
"Oh Thou, who changes not, abide with me!"

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## *Reflections from the Editor: Beginnings and Endings*

# *International Society for the Study of Time*

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London, England

M. S. WATANABE, 1969-  
Honolulu, Hawaii

April 25, 1974

### APERIODIC NEWSLETTER No. 1

More than half of the replies submitted in response to the questionnaire that was prepared and sent out by the Evaluational Committee, expressed desire for a newsletter of some sort. This communication is a response to those requests. Both the aperiodicity and the informality of this Newsletter will stay with us for the foreseeable future.

So began the first ISST newsletter, composed, typed, duplicated and distributed by J.T. Fraser in 1974. It was a response to the "expressed desire" of the membership for continuity and communication and the beginning of an international link between scholars interested in time. Since then, the newsletter has continued to bring news, reports, book reviews and conference information to members of this society—still on an aperiodic basis as the need arises, still encompassing both spontaneity and expectation.

Over the years, several ISST members have assumed the responsibility for editing *Time's News*: J.T. Fraser (1974-1979), Sharon Schwarze (1980-1986), Richard Martin (1987-1988), and John G. Weihaupt (1989). I have enjoyed the position of editor from 1990 to 2000.

As the millennium now comes to its official end and as the decade during which I have edited *Time's News* also comes to its end, it is time to look ahead to change and new beginnings. In this last issue under my editorship, I am pleased to announce that Jo Alyson Parker will be the new editor, beginning with the next newsletter, the first of the new millennium, scheduled to appear in February.

Dr. Parker is currently an Associate Professor of English and the Director of Gender Studies at Saint Joseph's University in Philadelphia. She

is the author of several published essays on William Faulkner, Elizabeth Inchbald, Stanislaw Lem and Laurence Sterne. She has also published *The Author's Inheritance: Henry Fielding, Jane Austen, and the Establishment of the Novel*. Her interest in narrative time brought her to ISST, and she has served most capably for several years as Book Review Editor of *Time's News*. We are fortunate to have such a fine scholar and enthusiastic ISST member assume the position of Editor and continue this traditional communication link that now extends to over 32 different countries.

In closing, I would like to express my appreciation to the members of ISST who have helped me over the past ten years, either with news items, editing, suggestions and comments or kind words of support. Finally, I extend my most heartfelt thanks to J.T. Fraser for the assistance and encouragement he always gave in such abundance. From him, I have learned much about time, about editing and about the depths of the human spirit.

Marlene P. Soulsby

*...to make an end  
is to make a beginning"*  
(T.S. Eliot)

## *A Word from the President* **THE TRIPLE UNCERTAINTIES OF TIME**

Recently, I reviewed the proposals that have been accepted for the forthcoming ISST conference at Gargonza, and I realized that despite their disciplinary diversity, one way to class them is to determine whether they talk principally of the uncertainties of the future, of the present, or of the past.

How different would you be if you were absolutely sure about the events that will mark your life? Uncertainty about the future is a most common theme to all disciplines; it strongly shapes our personality and our behavior as human beings, if only because, as was noted by one proposal, "pleasure has to be deferred in order to become certain and real". But there is also the possibility that uncertainty has in fact an ontological root, that "the flow of time be an epistemic interpretation of an underlying ontology of change", as was phrased by another proposal. The pervasive role given to chance in scientific explanations of quantum, biological, physical and cosmological phenomena certainly points to this direction.

Uncertainties about the present call principally upon the imagination of physicists, because of Heisenberg's so-called uncertainty principle between energy and time. Events should last long enough to have a definite energy, that is, to be fully specified from a scientifically descriptive point of view. But uncertainties about the present call also upon the inquiry of philosophers and psychologists alike, particularly because of the uncertain relationships between the content of the

psychological present and the external events that gave rise to conscious perception.

But perhaps the most exciting thoughts come to mind when considering the uncertainties of the past (in relation to the present). This is the domain of the subjective construction of the ego, thus of deep psychology. This is the domain of law, of adjudication. This is the domain of nostalgia, thus of art and literature. How will the development of cyberspace and hypertexts, which inflate the spatialization of time once denounced by Bergson, affect our way of thinking about time?

Will you participate in the ISST Conference in Gargonza? The time of our eleventh conference is approaching, and the uncertainty about its shape seems to be progressively shrinking. Rarely has an ISST conference had such a broad, wide, and encompassing theme of interest for so many disciplines and scholars.

Rémy Lestienne

P.S. This issue of Time's News is the last which has been carefully prepared and produced by Marlene Soulsby. I am sure that every member of ISST knows what we owe to her talented dedication in the past years, and join me in warm applause. Time's News will however continue, of course, and we thank Jo Alyson Parker who has kindly accepted to take its destiny in her hands. Fair journey, Time's News!

### ***The International Society for the Study of Time***

will hold its eleventh conference

***July 8-14, 2001***

at Castello Di Gargonza,  
90 Kms from Florence, Italy.

The occasion marks the 35<sup>th</sup> anniversary of the founding of the Society,  
an interdisciplinary professional organization.

The theme of the conference is:

***Time and Uncertainty***

Conference details and registration will be in the February issue of Time's News



## Time's Books

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Please address correspondence concerning this column to the Book Review Editor. The opinions stated are those of the reviewers, and the reviews are their intellectual properties. But, because they are © 2000 Time's News, if you wish to quote from any of the reviews or republish a review written by you, please cite this newsletter and its date.

In the past, Time's Books has occasionally featured independent, multiple reviews of certain books. This column carries a second review of Levine's The Geography of Time (cf. Time's News 28); it is not a rejoinder

If you wish to write an unsolicited review—in English—of any serious time-related book, published in any language, please check with the Book Review Editor for preliminary approval, length, and deadline. Note that we are not looking for synopses but for professional peer evaluations.

### Books Received

Barthakur, Jitendra Kumar. Time. New Delhi: Kumud Books, 1999. 350 pp.

Read, Kay Almere. Time and Sacrifice in the Aztec Cosmos. Bloomington: Indiana University Press, 1998.

Richards, E. G. Mapping Time: The Calendar and Its History. Oxford: Oxford University Press, 1998. xxi + 428 pp. (Uncorrected reading copy)

### List of Reviewers:

Mark H. Aultman, Westerville, OH, USA (MHA)

Lawrence Fagg, Washington, DC, USA (LF)

Sabine Gross, Madison, WI, USA(SG)

Fritz Guy, Riverside, CA, USA (FG)

Zachary Jacobson, Ottawa, ON, Canada(ZJ)

Samuel L. Macey, Victoria, BC, Canada (SLM)

Jo Alyson Parker, Philadelphia, PA, USA (JP)

**Barnett, Jo Ellen. Time's Pendulum: The Quest to Capture Time—From Sundials to Atomic Clocks. New York: Plenum Press, 1998. 340 pp.**

Jo Ellen Barnett's *Time's Pendulum* deals with the history of time measurement, a subject with which most members of ISST will have at least a minimal acquaintance. Part One, "The Time of Day," is concerned with such familiar subjects as temporary hours (dividing the day or night into twelve equal parts),

canonical hours, and equal hours; together with tools for time measurement such as sundials, water clocks, and clock escapements; as well as the verge-and-foliot, and the pendulum; and ultimately the quartz watch and the atomic clock.

Part Two, "The Time of the Earth," is concerned with our efforts to establish a temporal measurement of the history of the earth. Starting with the cyclic time of Greek and Asian mythologies, Ms. Barnett then leads us through the Judaeo-Christian construct of

linear time leading ultimately to the world that Bishop Ussher asserted in 1650 to have been created on October 23, 4004 B.C. The Judaeo-Christian construct of time had earlier been undermined when Copernicus and Galileo questioned whether our earth could be at the center of the universe, and such doubts became ever more persistent with the work of the geologists, beginning with Steno (1638-1686). Steno—who had suggested that the earth's history could be read from its strata—became, however, ordained as a priest and spent the rest of his life as a zealous servant of the Catholic Church. The Industrial Revolution—with its canals, roads, mines and subsequently railroads—resulted in the strata of England becoming more and more of an “open book.” James Hutton (1726-1797) studied the strata in this open book and gave the world its first revelation of “deep time,” clearly going far beyond the 6,000 years of Ussher. Hence came the “dark abyss” into which those of religious faith were hesitant to look.

William Smith, the canal surveyor, placed fossils in their respective strata, which led to the Geological Column with its linear temporal divisions into eras, periods, and epochs. Charles Lyell (1797-1875) provided wider acceptance for Smith's views, but remained with Hutton's cyclical vision of time and did not accept Smith's more dangerous linear vision until the tenth edition of *Principles of Geology* in 1866. Charles Darwin's indebtedness to the earlier version of Lyell's work is well known. By then Buffon (74,832 years) and even Kant were considering a linear cosmic time frame far beyond 6,000 years. From now on, the physicists would take over, and Lord Kelvin began with an estimate of ninety-eight million years in 1862. Ultimately, it would take the discovery of radioactivity and its steady rate of decay to make an accurate measurement of the age of the earth possible. This measurement did not occur until 1956 when Clair Patterson of the California Institute of Technology used a variant of the uranium-lead clock to obtain a reading of 4.55 billion years. While that system has proved excellent for measuring longer periods, it was not until the advent of carbon-14 dating, with its half-life of 5,730 years, that shorter periods of up to 50,000 years could be measured with accuracy. This achievement demonstrated beyond reasonable doubt that our own species has been as subject as any other to evolution through time. Indeed, how

are the mighty now fallen, and Barnett rubs in our dilemma with an almost Swiftian delight.

In summary, there is very little factual information in *Time's Pendulum* that could not be found by sifting through encyclopedia entries under horology, archaeology, astronomy, geology, physics, and time's measurements and divisions, but the lively perspectives provided by Barnett's synthesis make it very well worth reading. By way of examples, her short opening chapter on the moon shows how the whole premise for measuring “The Time of Day” is dependent on a moon whose early gravitational friction slowed down each revolution of our earth from a period of approximately eight to twenty-four hours—so much for the immutable nature of life's diurnal rhythms. Another chapter, “The Selling of Time,” deals with usury in the Middle Ages and its unacceptable heresy of using and selling the time created by God. Ben Franklin's later business-centered assertion that “time is money” only demonstrated how much had been changed by the late eighteenth century. The chapter on “New Vibrations” deals with the enhanced accuracy of quartz and atomic clocks, and will also alert us to the parallels with measurements at the atomic level that ultimately quantify accurately the longest periods of time. Finally, the short chapter on “The Longitude” might be profitably read in conjunction with Dava Sobel's recent bestseller *Longitude*, which could suggest that we may now be witnessing the advent of female science writers who are providing intriguing new perspectives on historical events that are so central to our discipline.

(SLM)

**Borgmann, Albert. Holding on to Reality—the Nature of Information at the Turn of the Millennium. Chicago: University of Chicago Press, 1999. 288 pp.**

Billed as a history of information from its inception in the natural world through today's virtual reality, this book, by a professor of philosophy in Montana, can also serve as an introduction to the history of socio/cultural communication, providing a link between the temporality of the individual mind and that of society.

The author starts by distinguishing information from the reality to which it refers. Natural signs emerge from and disappear into

their environment—an expanse of smooth gravel indicates a river, an arrangement of twigs a nest, paw prints a passing animal. Conventional signs, on the other hand, have unnatural prominence. A mound of stones (a cairn) may mark a temporary or permanent trail or place, or serve as a memorial. Conventional signs became more distinctive and powerful as they became mobile—"signs come to stand apart from things and at the origin of entirely new things." The movement through notches on sticks or pebbles, tokens, marks on clay, letters on stone and papyrus, and words and maps on parchment permitted conventional information to become cultural information. Covenants helped tribes become nations, plans permitted cathedrals to be built, and scores enabled musicians to perform.

Borgmann further distinguishes technological and conventional information. Cultural signs provide information for reordering and enriching reality. Technological information lifts both the clarity and the transformation of reality to a higher level of lucidity and power. Natural and cultural information is *about* and *for* reality; technological information becomes information *as* reality. There is no clear way, Borgmann goes on, to get from the matter and energy of physics to significant structure (that is, to patterns or landmarks that serve as principles of order). One can distinguish structural (patterns) from cognitive (selected) information, but at some point everything still tends to become information, that is, what is (known). Reality is ambiguous, and we have freedom to construct it this way and that, but that freedom is limited by the placement in context.

In the ancestral environment, the message of a sign was sent by a thing: that is, meaning flowed between objects and subjects. In the digital information environment, reality has become silent and declined to the level of structural information, where semantic energy flows only from subject to object. Oral culture emphasized memory (individual and collective), which by necessity was anchored in context. Tallying, recording, and marking eliminated the necessity of remembering the number of things or events and, because the objects embodying them were mobile (unlike landmarks or monuments), also diminished context. Writing, particularly alphabetic, carried the tendencies further. Symbols on five disks indicating five sheep eventually could be a symbol for sheep irrespective of number. This kind of writing

(logographic) imposed heavy burdens on memory but nonetheless permitted culture (as in China) to flourish. Phonetic writing, based on sounds, increased efficiency—instead of a symbol for "slipper," sounds for "slip" and "per" (which also have other meanings) could be combined, reducing the number of necessary signs. Alphabetic writing simplified things further, transposing audible to visible. This transposition carried further the tendency of writing, as contrasted with speech, to detach information from context, persons, and memory.

Natural signs did not get in the way of things—they emerged, referred, and disappeared. Conventional signs, particularly with writing, hung around apart from context. By Plato's youth, Athens published its laws for all to see, on walls, pillars, tablets and papyrus rolls. The proliferation made it virtually impossible to know what was current and what not. Plato contrasted real knowledge, corresponding to eternal forms, with ephemeral writing. But writing maintained itself over time, thus achieving power and influence. Particular documents memorializing occasions came eventually, with their precision and permanence, to overwhelm the ephemera of remembered agreements and events. They became (as with the Normans' Domesday Book) powerful administrative and legal tools. They provided a basis for common understanding not just at a time but over time, creating cultures that could last. Writing brought near in time and space what would otherwise be too remote to have occurred, fostering realization in art and artifact, as possibilities of imagination or conception. It did so for all its readers, making knowledge more uniform and thus social.

Borgmann considers the digital. The symbols of an alphabet are not the least number of signs needed to convey information; two will suffice, as in a binary system of 0 and 1. A choice between two possibilities yields one piece of information. For example, a long-distance communication of 0 might mean that the team won, and 1 might mean that the team lost. But if two symbols can be communicated, four possibilities can be conveyed (the team won, and X hit a home run: 0,0; the team won, X did not hit a homer: 0,1; the team lost, X did hit a homer: 1,0; and the team lost, X did not hit a homer: 1,1). Three bits permit eight possibilities (or combinations), and so on: as more bits are added, more contingencies can be covered.



Some information theorists thus hoped to be able to marry structure to contingency in a potentially infinite combinatorial system covering all or most possibilities. But while there are instances where the match between signs and things is so close that the number of bits is an effective measure of the contingency of things (where all that matters is whether the team won and X hit a homer), this requires an artificial, antecedent, partitioning of reality. While information technology may not enhance information *about* reality, though, it puts at our disposal information *for* (shaping) reality: that is, it provides a measure of choice in selecting a message. But what this has done in practice, Borgmann says, is enlarge the space of choice such that structure and resistance have been lost.

Borgmann tracks through Boolean algebra and the development of transistors and computers. Combinations of two signs and basic operations are powerful enough to do the most complex calculations and manipulate images or guide missiles. Technological information combines digital rigor, massive logic and data structures with rapid processing. Analog information (maps, film, tapes, vinyl records) can be massive and easily handled, but it is in constant danger of "falling back into reality"—every time it is copied or displayed, it suffers damage. Technological information (though mysterious to many) is permanent, perceptive and pliable. It opens up, rendering transparent (its) reality. Natural information did not encompass reality—memory never covered an entire world.

Plato also dreamed that the structure of a sign corresponded to its reality—in eternal forms. A computer makes possible the detailed matching of structure and sign in the region of reality it sets off. You *have* Bach's cantata when you play your CD—it is not *about* or *for* the cantata (as a score would be). It replaces, or becomes, reality. Virtual reality, with its ambiguous relationship to reality, blurs lines between fact and fiction. Digital structures by themselves, like Plato's forms, are more enduring than material ones—they survive over time, remaining the same despite copying.

But technological information has its own fragilities—it is dependent upon technologies that are constantly being rendered obsolete and replaced. And it tends, even more than writing or printing, to lose its link to doing and experience. The timing, spacing, and socialization that were formerly a part of discipline

needed to sustain effort are less necessary. Information floats in cyberspace, becoming an overlarge smorgasbord or an aspect of overload. The lightness of information no longer nourishes the culture; it threatens to suffocate it, eroding connections with experience. Borgmann calls for an adjustment so as to restore a fuller balance between information and human capacities.

The foregoing summarizes Borgmann's argument. When one seeks to find, though, what might be the reality that the title of the book wishes to be held on to, things become slippery. Borgmann evokes cultural images (great cities, cathedrals, and music) and natural ones, the latter mostly Big Sky Montana plains and mountains. Reality to Borgmann, it seems, is nostalgic, a natural world enhanced by past culture, before technology took over.

We all know what reality is from experience, but if you ask what it is, as Augustine does with time, we cannot say, exactly. The urban inhabitant's reality may consist mostly of streets, buildings, appliances and artifacts. Reality is an aspect of consequences experienced in the environment where we act and are acted upon. A distinction between the natural and man-made does not correspond to real and not real: it makes no sense to say that the automobile that can kill us if we cross the street is less real than the mountain we see in the distance. This is not what Borgmann does (cathedrals and music are part of his reality), but there is still a sense of reality as preexisting, as what must be held on to lest it be lost in the rush of time. But while reality must include that, it cannot be only that.

Reality is not simply what we know or discover to be already "there." This Platonic view of reality, as things corresponding to ideas, is a holdover from trying to philosophize about the world in a writing/print mental environment where words are experienced as outside us and separate. It is not words or ideas, however, that constitute reality. We do not need to hold on to reality; reality is what holds on despite us, even if it was made by us and has no sense or meaning apart from its use to or by us. Reality is the larger environment that exists both before and without us and as a result of our (individual and social) activities that affect it.

When Borgmann laments the loss of reality, he recreates Plato's philosophical lament in



modern form. Language, like information (of which it is a part) was originally contextual. Eat this, don't eat that, watch out for that animal, look at that moon. It was linked to memory (this food killed my baby, this did not, animals that look like that have attacked us, I saw that light up there after last darkness), and it was social (other babies in the group did not have to die, dangerous animals could be avoided, and the regularities of the moon's appearance could be recorded). Writing, though, meant that words might no longer convey messages between people—they might just sit alone on a tablet or papyrus roll.

Plato wanted words anchored in eternal forms, so meaning could persist. He (almost despite himself) and his fellow Greeks left texts, or fragments of texts, which became the way they spoke to later scholars. Texts created chains of thought, of logic, and of precedent, and carried them over time. Scholarship came to be a recognition and reconciling of words in text, citing them as precedent, to bind or be distinguished and left behind.

The power of text, however, was dependent on the perceived link of thought/word to reality. Knowledge, wisdom, and experience were seen as part of an ability to predict and control consequences. The more that is known about past patterns (or repetitions), the better that likely consequences can be foreseen. Knowledge that permitted prediction, control, or change of reality was a source of power. But if the link to reality (the ability to act and interact) was lost, knowledge could become a manipulation of symbols that might (and as more knowledge proliferated without consequence, was increasingly likely to) make no difference. Where correspondence of ideas to reality could be verified by consequences, ideas retained significance. But where verification was simply a matter of correspondence with past patterns of information (with text or digital information) significance was lost.

The modern (or postmodern) objection to information in cyberspace, in other words, recapitulates premodern objections to abstract or arcane texts in libraries. And it provokes the same sociological reactions: if knowledge is power, its more widespread availability means that someone with formerly privileged access to information is losing power. And, to the extent that knowledge is defined economically (as something more scarce to one person than to another and for which someone is therefore

willing to pay), it also loses value. Borgmann recognizes the tenuousness of the links between information, structure, and reality, but he still tends to view reality as Plato did—as an aspect of preexisting structure. Structure is good, and necessary to maintain links to reality, but should not be viewed as just preexisting. It is not reality, nor the living human being, that balks at contingency; it is only the human mind, deprived of context and thus consequence.

(MHA)

**Brann, Eva Brann. *What, Then, Is Time?* Lanham, Md.: Rowman and Littlefield, 1999. xvi + 237 pp.**

For readers with an affinity for (and preferably some acquaintance with) Western philosophy, this is an interesting and challenging book—interesting because of its passion and eloquence, and challenging because of the questions it raises explicitly and implicitly. Eva Brann, a tutor at St. John's College in Annapolis, Maryland, first takes us on an interpretive tour through major philosophical texts on time—texts that, as she notes in the preface, “vary from hard to hellishly hard” (xiv). Then she offers her own answer to Augustine's famous question, which gives the book its title. As it turns out, Augustine also provides much of the conceptual as well as spiritual inspiration for Brann's own interpretation of time.

Good thinking requires making appropriate connections and distinctions, and one of the virtues of this book is its unexpected pairings of thinkers—usually from quite different eras—and its noting of comparisons and contrasts. Plato and Einstein both understood time as a clock—Plato thinking of one great cosmic simultaneity, and Einstein thinking of innumerable local synchronicities. Hegel and Bergson both contrasted time with space—Hegel seeing time as the truth of space, and Bergson seeing space as the falsehood of time. Aristotle and Kant both regarded time as the product of the human mind, and specifically, of the mental act of counting—Aristotle going from the “before” and “after” of change to number to time, and Kant going from a priori time to number to change. Plotinus and Heidegger both grounded time in a higher reality—Plotinus deriving time from eternity; and Heidegger from humanity. And Augustine and Husserl both understood time as a

stretching of the human psyche to integrate memory and expectation with perception—Augustine living in a divinely-created world, Husserl delving into a self-created interior. Of these five presentational pairs, Aristotle/Kant and Augustine/Husserl get significantly more attention than the others.

The expositions of various figures are consistently appreciative, even when Brann does not share their views. While she forthrightly expresses her own convictions, she has obviously done her homework. She sets each philosopher's view of time within his overall project, often illuminating the larger whole as well as the smaller part.

This detailed exposition and interpretation, which occupies more than two-thirds of the book, forms the foundation for the constructive reflections of the last two chapters. The first of these chapters elaborates the "flux and fusion" of the phases—past, present, and future—of time, and describes their respective pathologies: the "strutting point" of the present, the "slouching beast" of the future, and the "night of time" of the past. Of these, Brann thinks the most seductive is the "the slouching beast" of the future. The catalogue of time-pathologies reflects her conviction that "coming to terms with time might, even must, influence the conduct of life" (xii).

The concluding chapter emphasizes, first, what Brann believes time is *not*. It is not the external time of physics, which really ought to be called motion. It is not physical or biological becoming, which itself presupposes the subjectivity of consciousness. It is not a power or force that can cause change. It is not a commodity to be saved, spent, or invested. It is not merely a locution to be understood according to its "grammar." It is not equivalent to human being, which is more than temporality. It is not an entity of any sort.

Then Brann describes what she believes time is. Most importantly, time is internal to human consciousness and subjectivity: "Without our watching and noting and remembering, no natural process is temporal." Time is fundamentally phase-time, which constitutes a kind of temporal triunity of co-presence. Time is also succession-time, the pulsing of time in the self-consciousness of an internal "now," from which arises an awareness of duration and temporal distance. Time thus presupposes a consciousness distinct from spatial and natural reality. Yet, time remains a

mystery, "lucid in parts and obscure as a whole" (216).

Throughout the book Brann offers frequent asides on the nature and history of philosophical thinking. "A definition is at best a mnemonic of completed thought and has no interest except as a summary of past philosophic activity or as the starting point of a formal system" (13). "Little can be said in philosophy that is not indebted to Aristotle" (35). "The (pagan) ancients were over and over again on the brink of becoming modern" (56). "Inquiry has more to say than discovery" (112, 117, quoting Augustine). "Each theory . . . opens up pitfalls precipitous in proportion to the profundity of its truths" (159). And she often demonstrates her delightful gift for turning a phrase: "the potent nonentity" (xi, 189), "charming cluelessness" (36), "temporal pointillism" (182), "mystical self-spooking" (192),

Besides the intrinsic complexity and subtlety of the texts with which it is concerned, the book offers the challenge of its major premise: that time is essentially the product of human existence rather than a phenomenon of external (that is, natural) reality. This conviction is frequently reiterated: "Time is *not* natural passage" (7); "The time of natural science arises as an illusion" (31); "It is impossible for time to be if there is no soul" (45); "Time never shows up externally. . . . Nor is it a relation of real things" (200). But nowhere is this thesis persuasively argued, and sometimes, as in the case of Aristotle, the historical precedents seem forced. Consequently, readers may wonder if Brann fails to distinguish the *nature* of time with the *awareness* of time, even though this distinction is implied in Husserl's designation of his subject not as *time* but as *time-consciousness*.

Less importantly (in the context of the book), readers who appreciate Brann's unobtrusive theism may nevertheless question her casual acceptance of the notion of divine timelessness, a notion now increasingly questioned by philosophers of religion. But all readers who work their way through her book will be not only challenged but also well rewarded for their diligence.

(FG)

**Gleick, James. Faster: The Acceleration of Just About Everything. New York: Pantheon Books, 1999. 324 pp.**

James Gleick explores the many ways in which our lives, or at least the activities and technologies that increasingly come to define our lives, are becoming faster. This witty, readable book is very strong on sociological description and, perhaps as a function of descriptive strengths, weaker on analysis.

Gleick starts in the Directorate of Time (yes, there really is such an agency—it is part of the U. S. military) in Washington, D.C. It measures, standardizes, and renders time precise, facilitating modern communication and global positioning systems. An error of one billionth of a second means a positioning error of a foot—the distance light travels in that time.

Gleick charges through Type A personalities, computerization of elevators, digitalization of clocks, standardization of time into spatial zones, measurement and acceleration, the camera and slowed motion, rapid communication and the creation of “real time” (what happens “as we speak”), miniaturization of computer technology, fax to internet to information overload, the growth of “simplify your life” movements (communicating through technologies that speed it up), and instantaneous public opinion polls. After the first 100 pages Gleick slows down a bit to consider human effects. In “Decomposition Takes Time” he considers the significance of composting, pauses in music, and the Sabbath. He concludes from studies of brain size and speed that intelligence may be a function of knowing both when to think quickly and when to think slowly.

Technology, he goes on, seems naturally to evolve toward saving time, but reaches limits. Studies of freeway congestion show it is a function of not just absolute numbers, but of the dynamics of complex systems. Accidents leave a kind of aftershock “memory” long after the autos are cleared. Small slowdowns magnify into larger ones because of increased sensitivity to small perturbations near saturation points. Office technologies permit work away from the office, blurring the distinction between hours worked and leisure, and statistics from different sources show hours worked both increasing and decreasing: measuring how time is actually spent is inherently unreliable because people tend to

forget the small tasks (drinking coffee) and do multiple tasks at the same time.

Movies, TV, and media in general have speeded up. We no longer watch a character park the car, get out, and walk to the door. TV no longer pauses at the end of one show and beginning of another. The remote-control generation gets too bored with “dead time.” Commercials and MTV move rapidly from cut to cut (the latter in time to the music), assuming the viewer knows what is “in between” and does not need to waste time seeing it. People tend to talk at the rate of 150 words per minute, but they can process speech at 500 to 600 w.p.m., and mass media, for both economic and boredom-avoidance reasons, tend to provide information at levels of maximum comfortable speed. Classical music used pauses for dramatic effect; now the pauses are often eliminated to avoid “dead air time.” Fast cutting, narrative gaps, highway lane changes—the brain learns, adapts to, and maybe learns to desire, speed.

When complex systems whose speed is maximized are disrupted (bad weather in an air traffic control system, for example) delays magnify and cascade through the system. In the days when a plane flew from one city and back again, there would be an available plane close by if one broke down. Now they are routed by computer to minimize idleness. Complex systems operating near capacity have less slack; it is not the raw speed of planes, but the tightening net of regulation and efficiency that has become the time-saver when things go smoothly and the time-waster when they break down.

“Time-saving” once meant doing a less desirable task (like washing clothes) more quickly. Now it is a value in itself, creating time to do more rather than less. But often the issue is who saves the time. Telephone “lotteries,” in which calls for reservations or tickets are made at a certain time, with those getting through being “winners,” shift time wasted from the organization taking calls to the callers. Governments also tax citizen’s time—with waiting lines at tollbooths or agencies. But time is not money—individuals do not get back the same (interchangeable) time.

Short-term social memory is being eroded as media change. Not only do films, diskettes, and videotapes decay, but the machinery needed to play them become outmoded and lost. Maybe some of this is good: for centuries



words were spoken and never heard again, and pictures of events and most objects were made from memory. Amnesia may not be the worst problem—maybe humanity has become an obsessive packrat unable to leave behind even the minutiae of its past.

To search for analytical explanation amidst Gleick's descriptions may be asking too much, but Gleick offers some. We live in a kind of excitement the ancients knew only in battle; maybe appetite for speed comes from an evolutionary preference for adrenaline rush. He also suggests that, as technology becomes more complex, it speeds up as a function of interaction among constituents. And he notes that mass communication technologies tend to speed up to the information-processing level of audiences. Finally, he notes a law of small numbers—there are not enough to meet demands on them, so they often show patterns not sustained at higher levels. As number and complexity increase, we small-number people, who distill things to find order, pattern and lawfulness, are overloaded. While some judge the health of a community by its people's capacity to do nothing, he notes that ultimately people in groups can do more and that humans have not opted for slower. When we speed up the present, we slow the past (automobiles makes the horse seem slow). Maybe we are rushing against death, but maybe we have just experienced more, and so the present seems faster. These explanations are not mutually exclusive. Speed, like Aristotle's motion, is too basic an aspect of experience to pin down: it is motion contrasted with past motion. Despite tendencies of social complexification, both acceleration and deceleration are complementary aspects of time. (MHA)

**Halpern, Paul. The Cyclical Serpent: Prospects for an Ever-Repeating Universe. New York: Plenum, Press 1995. xxii + 280 pp.**

This is one of those enjoyable books that become known as a layperson's introductions for specialists. Halpern introduces us to a variety of cyclical universe models and, after spending not a little time on their cross-cultural mythic antecedents, he examines the modern scientific models in some detail. Halpern's descriptions of the cultural antecedents of time as a snake-eating-its-own-tail of the book's title, particularly the Hindu prophecies involving Vishnu and Brahma

(obviously Halpern's favourite metaphor) are compelling and poetic. His book is worth reading for that alone.

That review is followed by an interesting consideration of the science involved in the repeating models, ultimately asking of each what are humanity's possibilities inside the universal serpent if it turns out to be cyclic. In the interim, he gives the reader clear and spare expositions of the needed underpinnings—special relativity, general relativity and space-time, a very small dollop of quantum theory, the Second Law, and so forth. I cannot recall seeing so many of the topics of modern physics addressed so matter-of-factly or so briefly. Actually, some treatments are a little *too* spare. I felt that his discussion of the Hubble constant could have been a little more detailed for it to be truly a neophyte's introduction.

The standard version of the repeating universe, as speculated in some modern cosmology, runs this way: after the Big Bang, the universe's expansion runs out of steam and collapses back into a Big Crunch; then the cycle starts again, perhaps repeating endlessly. Readers of *Times News* will already be familiar with the notion of a cyclical universe. But you may not know all the variants there are of such a model; certainly I did not.

Throughout his treatment of the modern scientific cosmological repeating-universe models, Halpern keeps returning to the critical notion of space-time curvature. Either the universe contains enough matter to reverse its expansion, or it does not. If space is negatively curved (hyperbolic), the universe must be open, expanding forever. If it is positively curved (spherical), the universe must be closed, collapsing ultimately. Uncurved (flat, or Euclidean) space implies a universe carefully balanced that will continue to expand and not collapse.

At no time are we ever allowed to lose sight of Halpern's preference for some sort or other of cyclical repeating universe and its requisite spherical space-time geometry. The motivation for his enthusiasm—Halpern is quite open about it—for the cyclical universe(s) is human survival, or at least the survival of some human intelligence. He is upset about the thought of inevitable entropy-heat death by disorder implied by a single universe, expanding eternally. He would rather that humanity die with a bang in a Big Crunch than with a whimper in a slow decay to disorder. He



imagines that we will find some way, by the time it happens, to transmit some information about us through the Crunch and ensuing Big Bang. Not that a repeating universe necessarily saves us from such a fate. The boundary-free model postulated by Stephen Hawking is the most elegant repeating-universe model, but Hawking himself is convinced that universal entropy must necessarily increase throughout: death by disorder is still inevitable. That applies to the Tolman's oscillating-universe model as well (May we call it the Big Bounce model?); no matter how tight the initial universe is, the end state under this model is an open universe expanding to infinity. Halpern obviously hopes—with a religious longing—that humanity will find a way to at least retain information of our existence and thought for the use of successor intelligences in successor universes.

This brings up the central problem that I have with the book—It was written in 1995, and the observations intervening between then and now have not been kind to a closed universe. A wag might say that time caught up to this book. The most compelling observation was only published this year, and it joins a chorus of results that seem to me to fairly shout from the pages, "It's flat, dammit!" (See, for example, P. de Bernardis et al., "A flat universe from high-resolution maps of the cosmic microwave background radiation" [Data from the Boomerang project—a microwave sensor hoisted to a height of ~38 Km by a balloon], *Nature* 404 (2000): 955-959.)

That this long-standing question may be answered at last will all come as scant comfort for Halpern, of course, if he chooses to accept the Boomerang data at its face value. He might take some consolation from the fact that the need for entropy to increase inevitably with time is only apparent and known within *closed* systems. If the universe is open, entropy's inevitable increase might not apply over the universe taken as a whole. If—as now seems likely—the universe is exactly flat, it might be interesting to speculate on continuing sources of order in the universe, not closed but not entirely open either, which might somehow offset the steady increase of entropy in local closed systems. (Yes, I know there are no such sources currently imagined or postulated, but the possibility cannot be completely ruled out yet; it's the order of speculation Halpern invokes frequently in his book.) This in turn would allow some of the possibilities for

humanity that Halpern felt previously could only obtain within a cyclic cosmos.

Persons should read this book who wish a concise and non-technical introduction to cyclical-universe speculations or who wish a compendium of such models. For my part, I will keep it at hand as a source of short and simple descriptions of some of the more interesting and arcane corners in twentieth-century physics; and while it is nearby, I will return often to Halpern's evocative account of Hindu and other classical legends of the self-devouring snake-as-universe.

(ZJ)

**Heise, Ursula. Chronoschisms: Time, Narrative, and Postmodernism. Cambridge: Cambridge University Press, 1997. xii + 285 pp.**

Writers of fiction, as we know, have the happy facility to do anything they want with time—within the limits of their own understanding of it. They can mix up linear chronology, they can expand a moment through many pages of text or compress a decade to a brief paragraph, and they can invent time machines that send their protagonists back to the time of the dinosaurs or forward into some wondrous or horrific future. They can even, like Martin Amis in *Time's Arrow*, reverse the arrow of time so that the protagonist progresses from death to birth. The question, of course, is whether the games that writers play with time have anything to do with the time that we experience in the real world. In *Chronoschisms*, Ursula Heise mounts a persuasive argument that the restructuration of narrative time that occurs in the postmodern novel both reflects and illuminates "a broader transformation in the Western culture of time that has taken place since the 1960's and involves changes in science, technology, and socio-economic structures" (5).

Heise, who teaches comparative literature at Columbia University, deftly melds theory and practice in the text. She follows her detailed discussion of the postmodern experience of time by close readings of five representative postmodern novels, some canonical and some not. The writing is lucid and often engaging, and, although Heise necessarily deals with the fairly arcane concepts of poststructuralist theory, she eschews the rarefied vocabulary that can often daunt the general reader. She is careful, too, to avoid the grand claim that there

is a strict causal relationship between the revolution in our thinking about time and the temporal structures of the postmodern novel.

In part one of the text, "Chronoschisms" Heise synthesizes an impressive amount of material relating to the postmodern reconceptualization of time. Drawing on the work of social scientists and cultural critics, she begins by examining the claim that "Western societies in the late twentieth century have entered a stage of 'posthistory' or a 'crisis of historicity'" (11), explaining both what such a claim might mean and how it might pertain to the postmodern novel. As Heise argues, theories positing a crisis in historicity fall into two different types: (1) theories claiming that history has reached a standstill, society merely continually reproducing its own structures, and (2) theories claiming that technological, social, and economic changes that have taken place in late twentieth-century capitalist society have led to a speed-up of temporal experience, immersing us in a "hyper-present" that keeps us from connecting with the past or planning for the future. As she shows subsequently, these theories inform the narrative structure of postmodern novels.

In the latter half of part one, Heise elaborates upon what distinguishes postmodernism from other eras. She points out that although both modernist and postmodernist culture explore breaks or schisms in time, modernism "does not imply any doubt about the relevance of temporality for the organization of human experience, whereas this doubt is precisely what informs the postmodernist questioning of time" (35). Heise then turns to the natural sciences. Just as relativity theory and quantum mechanics informed the modernist conception of time, advances in the natural sciences over the past 30 to 40 years, which have brought to our awareness the different and seemingly incommensurable time scales pertaining in the universe, have contributed to the postmodern undermining of a sense of temporal coherence. Heise then offers a brief but thorough discussion of the connection between temporal experience and narrative time, and she pinpoints four characteristics of the time sense as articulated in postmodern narrative: a focus on the moment or the narrative present; the creation of different, alternative, sometimes mutually exclusive temporalities; a double symmetrization of time and causation; and a detachment of narrative time from any specific

human observer. Heise concludes her theoretical overview with a reading of John Barth's short story "Menelaïad," which she regards as encapsulating many of the temporal strategies that she explores in detail in the following two parts.

Parts two and three—"Time Forks and Time Loops" and "Posthistories"—offer readings of specific postmodern novels: Julio Cortázar's Rayuela (or Hopscotch), Alain Robbe-Grillet's Topologie d'une cité fantôme, Samuel Beckett's How It Is, Thomas Pynchon's Gravity's Rainbow, and Christine Brooke-Rose's Out. Within each of these texts, Heise locates some, although not necessarily all, of the four characteristics of the postmodern time sense that she defined in part one. Rather than submitting each novel to a cookie-cutter-like approach, Heise concentrates on different textual features. So, for example, in discussing Beckett's novel, she explores the issue of narrative duration whereas, in discussing Brooke-Rose's, she explores the undermining of temporal and causal logic. Heise comments on "the difficulty and sometimes even the tedium" that readers often encounter during their first readings of various postmodern texts (64), and it may well be that, with the exception of Rayuela and Gravity's Rainbow, many readers will not have tackled the texts that Heise examines. Heise, however, provides enough information about the plot (or, in many cases here, the anti-plot) that even non-specialist readers can easily follow her argument. In fact, her clear explanations of the temporal disruptions occurring in the texts may smooth the way for many readers, prompting them to turn (or return) to the novels themselves.

My only cavil with the text—and it is a slight one—concerns the epilogue, wherein Heise reads Bruce Sterling's cyberpunk novel Schismatrix in terms of chaos science. There is both too much and too little here. Heise makes claims about the significance of Sterling's novel that her analysis of it does not really seem to support. I wanted Heise to go further exploring how chaos science may lead to a reformulation of our notion of temporality. Her point that Sterling's novel presents time "as an infinite maze offering unlimited possibilities" (262) might be a good starting point for a more thorough discussion.

Overall, Chronoschisms is a worthy addition to the branch of narrative and novel studies that deals with time. Not only does it provide provocative and illuminating readings of the



postmodern novels with which it deals. It also enables us to understand the importance of literature for reflecting and constructing our understanding of time.

(JP)

**Levine, Robert. *A Geography of Time*. New York: Basic Books, 1997. 258 pp.**

The thrust as well as the style of this engagingly written book is conveyed by its subtitle: "The Temporal Misadventures of a Social Psychologist, or How Every Culture Keeps Time Just a Little Bit Differently." Levine's writing, while informed by his scholarly knowledge, simulates a conversation with his readers rather than presenting dry research data in academic format. It is largely based on his own experiences in Brazil, which he summarizes as follows: "The reasons that Brazilians' rules of punctuality so confused me, it soon became apparent, was that they are inseparably intertwined with cultural values. And when we enter the web of culture, answers come neither simply nor cleanly. Cultural beliefs are like the air we breathe, so taken for granted that they are rarely discussed or even articulated. But there is often a volatile reaction when these unwritten rules are violated. Unsuspecting outsiders like myself can walk into a cultural minefield" (xv).

Levine's presentation of the complexities and variations of temporal culture includes copious personal anecdotes about his experiences in Brasil, India, Japan and other countries. Many spell out fundamental differences, such as those between "clock time" and "event time" or between what the anthropologist Edward Hall has termed "monochronic" and "polychronic" time scheduling (96), that is, linear vs. "layered" use of time.

Levine and his students also conducted an experiment to measure the "pace of life" in different cities and countries—or, as he puts it, "to create a sort of social psychologist's places-rated guide to the fastest and slowest places to live" (xviii). The comparative study was conducted internationally in 31 countries, and ratings were a composite derived from three measures: downtown walking speed, the speed with which a standard request was fulfilled at a post office, and the accuracy of public clocks. Similar categories—with the addition of "talking speed"—were adopted for a study of comparative pace in 36 U.S. cities that "confirmed the

widespread impression that the Northeastern United States is fast-paced." (149) A follow-up study focused on the degree of helpfulness towards strangers. While it confirmed that the faster pace in Northeastern cities went hand-in-hand with less willingness to help (with New York, ranked third in pace, scoring lowest) it also discovered that the slower pace in California cities was correlated with a surprising unwillingness to extend help.

While one may quibble with the reductiveness of the experiment and the way in which highly diverse—and in many cases, divergent—measures were combined into a single score, the international study did yield coherent and comprehensive parameters, summed up by Levine as follows: "From these experiments and the research of others, one can determine five principal factors that determine the tempo of cultures around the world. People are prone to move faster in places with vital economies, a high degree of industrialization, larger populations, cooler climates, and a cultural orientation towards individualism" (9).

Levine has written a highly readable and original study of temporal experience in which he addresses—and assesses—its intercultural relativity and variation with a combination of critical analysis and common sense. Throughout, he reflects on his own presuppositions and preconceived cultural premises in presenting his experiences. He does not always succeed in this to the extent one might wish. Thus, in relating his experiences both in Brazil and in India, he fails to factor in the "stranger value" that would very likely affect others' behavior towards him. In several other instances, his language and concepts reveal a strong and uncritical allegiance to Eurocentric, specifically U.S., values—for instance, when he describes the work habits of certain agricultural or hunting-gathering societies as follows: "The Kapauku of Papua, for example, don't believe in working two consecutive days. The !Kung Bushmen work two-and-a-half days per week, typically six hours per day. In the Sandwich Islands, men work only four hours per day. . . . It requires one day for a Dobe woman in Australia to gather enough food to feed her family for three days. The rest of the time is her own—to visit, entertain, work on her embroidery, or, as is often the case, to do nothing at all" (14). The neatness of the divisions between work and non-work, the specificity of the hours and time



periods, and the very concepts of having time "of one's own" and doing "nothing at all" are based on the values and habits of industrialized and individualized societies, not of those purportedly described here. (And where, for the Dobe women, does the time of preparing food and cooking meals fit in?) Neither does he offer a precise definition or differentiation of the two terms "tempo" and "pace"—in fact, the two seem to be used largely interchangeably.

But the slippages in cultural awareness are occasional and, in the final analysis, can be taken to underscore Levine's very point about the ingrainedness of cultural parameters. This is an entertaining and—more than occasionally—eye-opening book that contributes to our knowledge about time as social practice and helps to increase the reader's awareness and cultural sensitivity, with the added bonus of providing helpful strategies for coping with temporal-cultural dislocation.

(SG)

**Raulff, Ulrich. *Der unsichtbare Augenblick. Zeitkonzepte in der Geschichte* [The Invisible Moment. Concepts of Time in History]. Göttingen: Wallstein, 1999. 143 pp.**

Raulff is a philosopher and historian turned journalist, and this brief and well-made volume (published in a series of "Conversations about History" under the auspices of the Max Planck Institute for History in Göttingen, Germany) offers four intelligent, informative, and elegantly written essays. The first two, as Raulff points out, are somewhat complementary: one on "long duration" (*longue durée*) and one on "the invisible moment". A third text focuses on art historian Aby Warburg, and the volume concludes with a piece on biography.

The introduction opens with a paradox: "Generally the nineteenth century is considered an uncommonly long century." The continuing sentence offers an explanation that points to the double use of chronological units such as "century": "It began with the French Revolution and ended only in the summer of 1914" (7). It thus takes us right to one of the core concerns of the historian—the doubling of temporal markers and measures as cultural, social, even stylistic ones. The first (and strongest) essay, in fact, not only traces the concept of "*longue durée*" from Braudel—who is associated with

coining the term and developing the layered model of time framing it—back to a number of precursors in the concept if not in the actual use of the term, but also offers insights into the craft of the historian and the dynamics of interpreting and constructing time as history. Raulff outlines how the twentieth century has replaced the concern with origins that marked earlier centuries by a preoccupation with presence. He sketches the discrepancy between Bergson's and Braudel's use of "*durée*" and then proceeds to illuminate the relationship of "*longue durée*" to its polar opposites "moment" (to which the second essay is devoted *in toto*) and "event." Beyond that, he moves from the autobiographical conditions of Braudel's work (which Braudel first embarked on as a prisoner of war, when "*longue durée*" offered distance from, and thus a new perspective on, the misery and politics of day-to-day existence) to a more comprehensive look at how "*longue durée*" came, at its precise locus in twentieth-century history, to appear so attractive to historians of completely different ideological persuasions: as a way out of—and beyond—some of the devastating developments that century had seen. Raulff's exploration of the ramifications of conceptual choices bears out his hope to have shown "that the choice a historian makes by deciding for a history of long duration or one of the significant moment is not only a decision between two modi of temporalization, but that it has aesthetic and ethical consequences and generally political implications as well" (48).

The second essay forges connections between the move of modernity from the singular moment to a variety of moments and the media-technical conditions (in particular, photographic and cinematic) propelling and enabling this transition. In this context, he ranges from the often-rehearsed history of the representation of a horse's gallop to Hegel, from Freud to Zapruder's film of the John F. Kennedy's assassination. His conclusion: "Recording devices such as cameras and tapes do not preserve facts, but semiotic material, the semantics of which remain a matter of interpretation" (84). His sketch—with a bow to Siegfried Kracauer—of the similarity between photographer and historian makes the following observation particularly significant: "The extension of the visible increases indeterminacy along with knowledge, complements the insight into the historical moment with the blots, veils, and shadows surrounding it" (82).



The third essay, the most limited in scope, provides a lead-in to the final one in its preoccupation with the possibility of telling various stories about individuals and their lives. It is the most limited in scope with its focus on art historian Aby Warburg's double attempts to revisit his 1895-96 visit to the U.S.—first in a lecture about his travels given in a mental asylum in April 1923 and then in his unrealized plan to return to the United States a second time. Raulff moves through a series of repetitions and doublings in this text—Warburg and Freud, Renaissance festivities and Native American ceremonies, Hopi and Anasazi, texts and travels—and deals with the extent to which Warburg's thinking was driven by a pattern of variation and repetition.

The fourth essay, "*Inter lineas* or Written Lives" charts the territory between history and biography in terms of their competing paradigms, claims, ambitions, and anxieties. Raulff points out that the reservations of history against biography can be attributed to its own "difficult birth" in the eighteenth century from "a confused magma of chronicle keeping, statistics, and hagiographic writing, of antiquarian knowledge and historical exemplars" (119). Raulff then confronts the criticism of historians that biography is always "irretrievably contaminated by legend" (120) and argues that legends and the like may always already be written into lives before any writing of biographies. Thus, it would be naïve to assume that what Bourdieu has criticized as the "biographic illusion" only comes into being as "biographers, writers, and historians cast their narrative web over the diverse and scattered facts of life, to impart to them direction, goal, and unity of meaning" (132). Raulff sees biography in "a productive dialogue with the inherent programmatical texts of lives" (133). As examples, he offers a number of diverse and intriguing biographies and models of biographical writing and self-invention, such as the double life of German literary scholar Schneider/Schwerte before and after the Nazi period, and he includes specific instances that either pay deliberate homage to the "legends" of the subject's contemporary life and subsequent reception as inseparable from that subject, or that set out to "construct" their subject in its "mirrorings and fractured reflexions" (139). Raulff's argument leads up to a more general point: The twentieth century has done away with our belief in "the coherent and consistent wholeness of subjects and their life trajectories" (140). Life, instead, is a "continued correspon-

dence of the *bios* with the ideas and accidents of existence, a constant reading and realizing of programs, a continuing rewriting of programs" (142).

What this volume offers is not exhaustive scholarly analysis or in-depth research. Rather, it is a stimulating guide pointing out features of an intellectual landscape; it forges connections and traces deep continuities in the development and interweaving of ideas. Well written and knowledgeable, it makes for rewarding reading.

(SG)

**Thorne, Kip S. *Black Holes and Time Warps: Einstein's Outrageous Legacy*. New York: W. W. Norton and Company, 1994. 619 pp.**

Kip Thorne's *Black Holes and Time Warps* is truly unique and exceptionally informative. It clearly stands out among the plethora of books popularizing physics and cosmology that have come out in the last two decades. Only someone who is both a gifted theoretical physicist as well as a lucid and engaging writer could have put together such an enlightening and easily readable book. As Feynman Professor of Theoretical Physics at the California Institute of Technology and author of three other books, Thorne easily can play both roles.

Thorne had the good fortune to begin his career in the early sixties, when gravitation and what Einstein's general theory of relativity can say about it were beginning to engage the attention of a slowly growing number of physicists. Being deeply involved in the earlier stages of this renaissance and having one-on-one professional contacts with virtually all of the great contributors in the field—from Yakov Zel'dovich and John Wheeler (who was Thorne's thesis advisor at Princeton) to Roger Penrose and Stephen Hawking—rendered him especially equipped to produce such a book. This background was coupled with his remarkable ability to blend into a story the lives, personalities, and idiosyncrasies of these leaders with painstakingly careful and simplified explanations of the physics they contributed. With such confluence of talent there is little wonder that Thorne's book, a national bestseller, is so amenable for the lay reader and that he received the American

Institute of Physics Science Writing Award in 1994.

One of the prime considerations of any physicist trying to write a book for the lay reader is how to begin in a way that will engage and not frighten the reader. Thorne's technique was to start with a prologue in the form of a thirty-five page science-fiction story about a space ship voyage to a series of successively larger black holes in which the space ship commander is attempting to approach each hole's horizon (point of no return) as close as safely possible. During the course of the voyage many of the fundamental gravitational phenomena characteristic of black holes and their proximity are encountered, and Thorne's descriptions of them serve as a gentle introduction to the more detailed descriptions that occupy the principal portion of the book.

In this portion, containing fourteen chapters, the author makes abundant use of figures and also boxes that explain in complete detail the concepts described in the text, often for emphasis repeating in different words what is in the text. In the first two chapters, after discussing Newtonian absolute time and space, Thorne describes the development of Einstein's thought, which led first to his special theory of relativity and then to the general theory of relativity as expressed in the equations equating space-time curvature to mass-energy distribution.

The next four chapters are primarily devoted to an account of the efforts to utilize Einstein's equations to determine the ultimate fate of a star when it burns up all of its nuclear fuel and is left to the mercy of gravity. This account essentially begins with the seminal work of Karl Schwarzschild and Subrahmanyan Chandrasekhar. The latter arrived at the limit of 1.4 solar masses, below which a star collapses to a white dwarf and above which to a neutron star. This was followed with calculations by him and others showing that a star of more than two or three solar masses should collapse to a black hole.

Thorne then follows with an engrossing narrative of the contributions of Zwicky, Landau, Wheeler, Oppenheimer, and others to the knowledge of neutron stars. Oppenheimer and his students, using an idealized calculational model for stellar implosion, showed early on that the existence and properties of black holes must be seriously considered. Thorne emphasizes how the

knowledge gained in developing an exploding nuclear bomb was later vital for understanding the nuclear properties of an imploding star.

In chapter seven, entitled "The Golden Age," he tells of the efforts primarily by American, Russian, and British theoreticians to reveal details of black-hole behavior beyond their being basically characterized by three numbers: mass, spin, and electric charge. Wheeler, Charles Misner (another student of Wheeler), Zel'dovich, Dennis Sciama, Igor Novikov, Penrose, Chandrasekhar, and the New Zealander Roy Kerr (who first showed that black holes could have spin), along with several others, played pivotal roles in elucidating these details.

Chapters eight through ten describe the experimental search for black holes and the gravitational radiation that is thought to result from their birth as well as their interaction with other stellar objects: other black holes, neutron stars, ordinary stars, etc. Especially interesting is Thorne's story of attempts to detect gravitational waves, beginning with the heart-rending disappointments of Joseph Weber and culminating in the design and construction of the Laser Interferometer Gravitational Wave Observatory (LIGO), several of which are planned for full operation throughout the world by 2007.

The following three chapters describe further calculated details about the nature of black holes. For example, Hawking showed that black holes evaporate by radiating particles through interactions with the quantum vacuum in the vicinity of the hole's horizon and ultimately will shrink and explode. The inside of black holes is mathematically explored in chapter thirteen, at root driven by Penrose's pivotal introduction of topology into the calculations.

Thorne ends his book in chapter fourteen with his conjectures, which he admits are unlikely in reality, about the "worm holes" that characterize the fluctuations in the quantum vacuum as possible time-reversing machines. Nevertheless, it is a fitting forward-looking ending to a highly readable, many-faceted, entertaining, and educational book, which will serve as an abiding standard for lay-directed science writing for some time to come.

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