JANUARY 1995

THE UNESCO COURIER

THE SUN

ANCIENT MYTHS
NEW TECHNOLOGIES

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Voltaire

Prayer to God

I now turn from men to address my words to Thee, God of all beings, of all worlds and of all time: if it is permitted to feeble creatures lost in the vastness and imperceptible to the rest of the universe, to dare to ask anything of Thee, who hast given all and whose decrees are unchanging and eternal, condescend to look with pity on the errors inseparable from our nature; let not these errors be our undoing. Thou didst not give us hearts to hate and hands to cut each other's throats; grant that we may help each other to bear the burden of a painful and fleeting life; that the little difference between the clothes which cover our poor bodies, between all our different and inadequate forms of speech, between all our ridiculous customs and imperfect laws, between all our senseless opinions and our estates, so disproportionately different in our eyes and so alike to Thee; grant that all these little nuances that distinguish the atoms known as men from each other may not be signals for hatred and persecution; that those who light candles at midday to worship Thee may tolerate those who make do with the light of Thy sun; grant that those who put a white cloth over their robes to say that men should love Thee may not hate those who say the same thing wearing a coat of black wool; that it may be the same to worship Thee in the jargon of an ancient tongue or of a newer; that those whose clothes are dyed red or violet, who reign over a small plot heaped from the mud of this earth and own a few rounded fragments of a particular metal may enjoy without pride what they call grandeur and riches, and that others may see them without envy; for Thou knowest that there is in these trifles nothing for envy or for pride.

Let all men remember that they are brothers, let them hold in abomination the tyranny exercised over souls, no less than the brigandage which forcibly robs labour and peaceful industry of their fruits! If the horrors of war are inevitable, at least let us not hate each other, let us not torment each other in time of peace, and let us use our moment of existence to bless, in a thousand different tongues from Siam to California, Thy bounty which has accorded that moment to us.

Treatise on Tolerance (1763)

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JANUARY 1995

Cover:
Montage of a photo of the sun above a sand dune and, inset, an 8th-century Indian miniature, *The Heart of Surya*, depicting the sun god Vishnu and his wife Lakshmi.

THE SUN

ancient myths new technologies

THE UNESCO COURIER

48th year
Published monthly in 30 languages and in Braille

"The Governments of the States parties to this Constitution on behalf of their peoples declare,
"that since wars begin in the minds of men, it is in the minds of men that the defences of peace must be constructed...
"that a peace based exclusively upon the political and economic arrangements of governments would not be a peace which could secure the unanimous, lasting and sincere support of the peoples of the world, and that the peace must therefore be founded, if it is not to fail, upon the intellectual and moral solidarity of mankind.
"For these reasons, the States parties... are agreed and determined to develop and to increase the means of communication between their peoples and to employ these means for the purposes of mutual understanding and a truer and more perfect knowledge of each other's lives...."
EXTRACT FROM THE PREAMBLE TO THE CONSTITUTION OF UNESCO, LONDON, 16 NOVEMBER 1945

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Month by month

This year, which the United Nations has proclaimed "Year for Tolerance", promises to have a full programme of international events: the centenary of motion pictures and radio; the fiftieth anniversary of the foundation of the United Nations and the adoption of UNESCO's Constitution (UNESCO did not actually become fully operational until the following year); two international summit meetings—the first, in March, on social development, the second, in September, on the situation of women.

As everyone knows, there is a world of difference between the gilded surroundings in which such events take place and the tragic situation in which hundreds of millions of people are afflicted with hunger, endemic diseases and illiteracy, and tens of thousands are killed, uprooted or traumatized by war, ethnic and religious conflicts, and outbursts of fanaticism. All those who, directly or indirectly, in intergovernmental and non-governmental organizations, work on behalf of international co-operation for peace, are constantly aware of the terrible gap between their dreams and the reality, between their efforts and the limited effects of their action.

To the question they often hear: "What's the point?", they unhesitatingly reply, "Without these dreams and efforts—despite the mistakes, failings and even sometimes the cowardice that tarnish them—what would happen? What would there be to resist the offensive of incomprehension and violence?"

The unique and patiently woven network of shared experiences, of successes and failures, that we call the international community is still irreplaceable. This does not mean that it cannot and should not change. On the contrary, at a time when it is celebrating its fiftieth birthday, in a world that has been completely transformed, the United Nations must also change and be given a new lease on life by the major powers that define the framework of its action. It must be instilled with determination to act for the common future of all rather than the immediate self-interest of each. And of course it must possess the means to implement its decisions.

The coming year, with its watchword of tolerance, will thus be a challenging one. The forthcoming international events will only make sense if they go hand in hand with clear thinking and well targeted action. The *UNESCO Courier* will keep its readers informed of what is being done to achieve these goals in the fields of culture, education, science and communication. We cordially invite you to express your opinions on these issues via our "Letters to the Editor" page.

We hope you will agree with us that the sun is an appropriate choice as the main theme of the first issue of the year. Central element in human mythology, emblem of promise and new beginnings, bringer of light, warmth, life and creation, the sun is now becoming, thanks to scientific and technological progress, a colossal source of usable, affordable energy. It is up to us to see that "the sun is for everyone" and that this energy is tapped for the good of the greatest number.

BAHGAT ELNADI AND ADEL RIFAAT

MONTSERRAT CABALLÉ

talks to Serafín García Ibáñez

One of the greatest singers of our time, the Spanish soprano Montserrat Caballé has won accolades in opera-houses all over the world. Her repertoire includes no less than forty roles, notably in operas by Mozart, Richard Strauss and Wagner, and in Italian romantic opera, in which she has specialized. She has been a UNESCO Goodwill Ambassador since 1994. Here she talks about her life and art.

■ **Let's begin with your childhood.**

—It was very happy; I had wonderful parents. Despite the Civil War and the difficult post-war period when you never knew where the next crust of bread was coming from, they were always happy and optimistic. It was a joy for us to make that crust multiply, as it were, by dipping it in water. A chunk of stale bread was turned into a kind of copious bread soup for the five of us.

My father and mother were always ready to help and share with others. My father always used to say that in this life we all travel together down the same road. This positive attitude on my parents' part provided me with solid foundations, a wonderful launching pad for life.

■ **How did you start singing?**

—Thanks to my parents. They loved music, especially classical music—Spanish music rather than opera, actually. We had a few records and the radio. And then they were always singing! I got a taste for music very early on, and it grew with age.

I didn't have the money to study, but I thought that if I could pursue an artistic career, by singing and serving the cause of music, then perhaps I would be able to learn something and at the same time contribute to my family some of the physical comforts we had lacked.

Later, when I was about eighteen or nineteen, I forgot about the materialistic aspects of my choice and fell deeply in love with music. I committed myself to it totally. It became a vocation, an absolute passion. Not only has it brought me a great deal of professional satisfaction, it was through music that I met my husband, who was also a singer.

In 1965 I had the opportunity to make my debut in New York as a stand-in for Marilyn Horne, who was expecting a baby. That opened many doors for me. While continuing to serve music, I have been able to do what I always dreamed of doing—help the suffering, especially young orphans.

My husband and I created a foundation which takes in 500 or 600 children a year on a farm at the foot of the Pyrenees. I also give charity concerts and am delighted to be able to contribute to UNESCO's work.

A soprano's voice is a little like a mother's cry, which is why it attracts all human beings.

■ **Is it true that you nearly gave up singing.**

—Yes. I had operations in 1974 and 1985 for tumours. But things couldn't have been too bad, for here I am chatting away with you! (Bursts into laughter)

■ **What are the essential attributes of a soprano voice?**

—Some sopranos have extraordinary range and can cover up to three octaves, but I'm not one of them.

A soprano's voice is a little like a mother's cry, which is why it attracts all human beings. The sound of a mother's voice expresses a feeling of great intimacy, which has a truly magical effect on the listener. You have to sing very, very badly for this not to happen. That's an enormous advantage that we sopranos have to start with. I am convinced that the sound of a soprano's voice affects people so strongly because it evokes maternal memories in each of us.

■ **In the course of your career you have sung in all kinds of opera, from Bellini to Verdi, from Puccini to Wagner. Wasn't that a little risky?**

—Of course! But I can't imagine any worthwhile work without an element of risk. You've got to take all kinds of risks if you want to grow and put the quality and value of your work to the test. I don't think that routine work is real work.

■ **Which have been the most difficult roles you've sung and which have you enjoyed the most?**

—Perhaps the most difficult or at least the most gruelling opera I've sung in is Bellini's *Il Pirata.*

Salomé is one of my favourite roles. I love the character and I love what Richard Strauss made of her. She is a product of that rare phenomenon, a real osmosis or communion between the librettist and the composer.

The role of Isolde is also exhilarating, but in Wagner the orchestra plays an important part. In *Tristan und Isolde* the real protagonist is the orchestra. Of course the singers have to be good, but even if they're not first rate, the opera still gives pleasure because of the prominent role of the orchestra.

I also love singing Norma, Semiramis, La Traviata. In fact I have enjoyed singing all the roles I have interpreted. Don't ask me to choose! (Laughter)

■ **When you mentioned Salomé, you talked about an osmosis between the libretto and the musical score. Doesn't that always exist?**

—I've always let myself be carried along by the composer's inspiration. If I feel shivers run down my spine when I listen to the music, even when I don't understand the words or know the story, then I know that the music is going to give depth to the character even if she seems unexceptional on a first reading. On the other hand, even with a well constructed libretto, if the music doesn't go with the character, then the character won't come to life on stage.

■ **It has been said that you have a sublime voice and are thoroughly professional but that you are not very interested in the acting side.**

—It's not that I'm not interested. It's just that I shall never accept that dramatic considerations should spoil the performance of the music. Opera is primarily music, which has to be well sung and interpreted. The dramatic aspect comes second, very important though it is. With a creative director you can put on a magnificent show, but today we're seeing too much superb visual presentation at the expense of the music.

In an opera house with an average of two or three thousand seats—some are even larger—it is imperative for the voices and the feelings they express to reach right up to "the gods". In a theatre with a smaller number of seats—between 600 and 800—expressions and gestures and the emotional charge they carry can be seen by everyone. To reach the most distant members of the audience and make them tingle, you must have voice, expression and feeling.

■ **The great singers learn their parts by heart in languages that are often not their own. Was that ever a problem for you?**

—Not for German. I began in Germany and lived there for six years. I speak and write the language fluently. Russian, on the other hand, and English have given me trouble. And as for French, I must admit that I don't pronounce it very well. Let's say that I've got a strong Perpignan accent. (Laughter)

■ **What happens if you forget your lines on stage, right in the middle of a phrase?**

—Oh boy! That's happened to me several times, and I'm sure I'm not the only one. When it does happen, the only thing to do is follow the music until you can pick up the thread again. If you suddenly dry up,

SELECTIVE DISCOGRAPHY

Brahms: *A German Requiem*, Sherrill Milnes, Montserrat Caballé, Boston Symphony Orchestra conducted by Erich Leinsdorf

Bellini: *Norma*, Montserrat Caballé, Plácido Domingo, Florenza Cossotto, Ruggiero Raimondi, London Philharmonic Orchestra conducted by Carlo-Felice Cillario

Donizetti: *Lucrezia Borgia*, Montserrat Caballé, Shirley Verret, Alfredo Kraus, RCA Italiana Orchestra conducted by Jonel Perlea

Puccini: *La Bohème*, Montserrat Caballé, Placido Domingo, Ruggiero Raimondi, Sherrill Milnes, London Philharmonic Orchestra conducted by Sir Georg Solti.

Richard Strauss: *Salomé*, Montserrat Caballé, Sherrill Milnes, Richard Lewis, London Symphony Orchestra conducted by Erich Leinsdorf

Verdi: *La Traviata*, Montserrat Caballé, Carlo Bergonzi, Sherrill Milnes, RCA Italiana Orchestra conducted by Georges Prêtre

All these recordings are on the RCA label

Montserrat Caballé with the Director-General of UNESCO, Mr Federico Mayor, at a ceremony to mark the singer's appointment as a UNESCO Goodwill Ambassador (22 April 1994).

you hang on to the last word you've sung and hope that you will be able to carry on where you left off.

■ **What about the type of Spanish operetta known as *zarzuela*?**

—I think it is a superb musical form and very much a part of our heritage. I have always tried with the modest means at my disposal to do what I can for *zarzuela* which, I seem to remember, was not always highly thought of at the beginning of my career. It went badly downhill during the Spanish Civil War in spite of the first-rate companies that managed to keep the tradition alive, that run by Plácido Domingo's parents, for example.

But things are better nowadays thanks to Tamayo and his company and the great conductor Atáulfo Argenta, who is fairly and squarely in the *zarzuela* tradition. Singers like Plácido Domingo, Teresa Berganza, Pilar Lorengar and many others have done a lot to bring about this revival. I personally am very proud of the Paris Grand Prix I received for a recording of a *zarzuela* recital.

■ **Can *bel canto* be practised in the open air?**

—It is a good thing that music is being performed in the open air today. It attracts a wider audience than the traditional opera-going public. But I think the open air is more suited to recitals of popular pieces, including *bel canto* arias.

Our music must not be confined to the elite of some 30,000 or 50,000 people who can afford opera seats; the hundreds of thousands of people who show up at big open-air concerts also have the right to hear it. But a recital is better because the visual element that is an essential part of opera does not work on a vast stage.

■ **In the same context, what advice would you give to a music-lover? To attend a live but perhaps mediocre performance or listen to a perfect recording?**

—It all depends on what you want. If it's perfection you're after, you'd do better with the recording, but to experience musical intensity, you need to be there in your seat. Recording techniques are now so perfect that recordings constitute archives that people can consult at home whenever they want. For myself, I like recordings as a reference, but for intensity of feeling I prefer a live performance. One's response is not at all the same. I say that as someone who sings, records and is never happy with the result. (A long peal of laughter).

■ **People say there's a crisis in opera.**

—Not as far as the public is concerned. The number of opera-goers and the sales of recordings prove that there are more fans today than there were twenty years ago. There are far more music-lovers now.

I would be more inclined to think that there is a social crisis. The theatre is going through a crisis because neither private benefactors nor governments have the resources to subsidize culture as they did thirty years ago. There are other, more urgent needs. So opera seasons get shorter; only two or three new productions are staged instead of fifteen or twenty. Only ten or a dozen operas are presented each year, whereas twice as many were put on twenty years ago.

■ **Is there a lack of new talent?**

—Absolutely not! The present generation of young singers is outstanding. But to make a name for yourself you've got to appear four or five times in the same place and come back year after year before people start to talk about you.

■ **One last question. What are your interests outside music?**

—I'd like to see all human beings, in different countries and within each country, draw closer together and understand each other better. I'd like to see the North and the South stop regarding each other uncomprehendingly and try to understand that what seems a defect in some may be a quality in others.

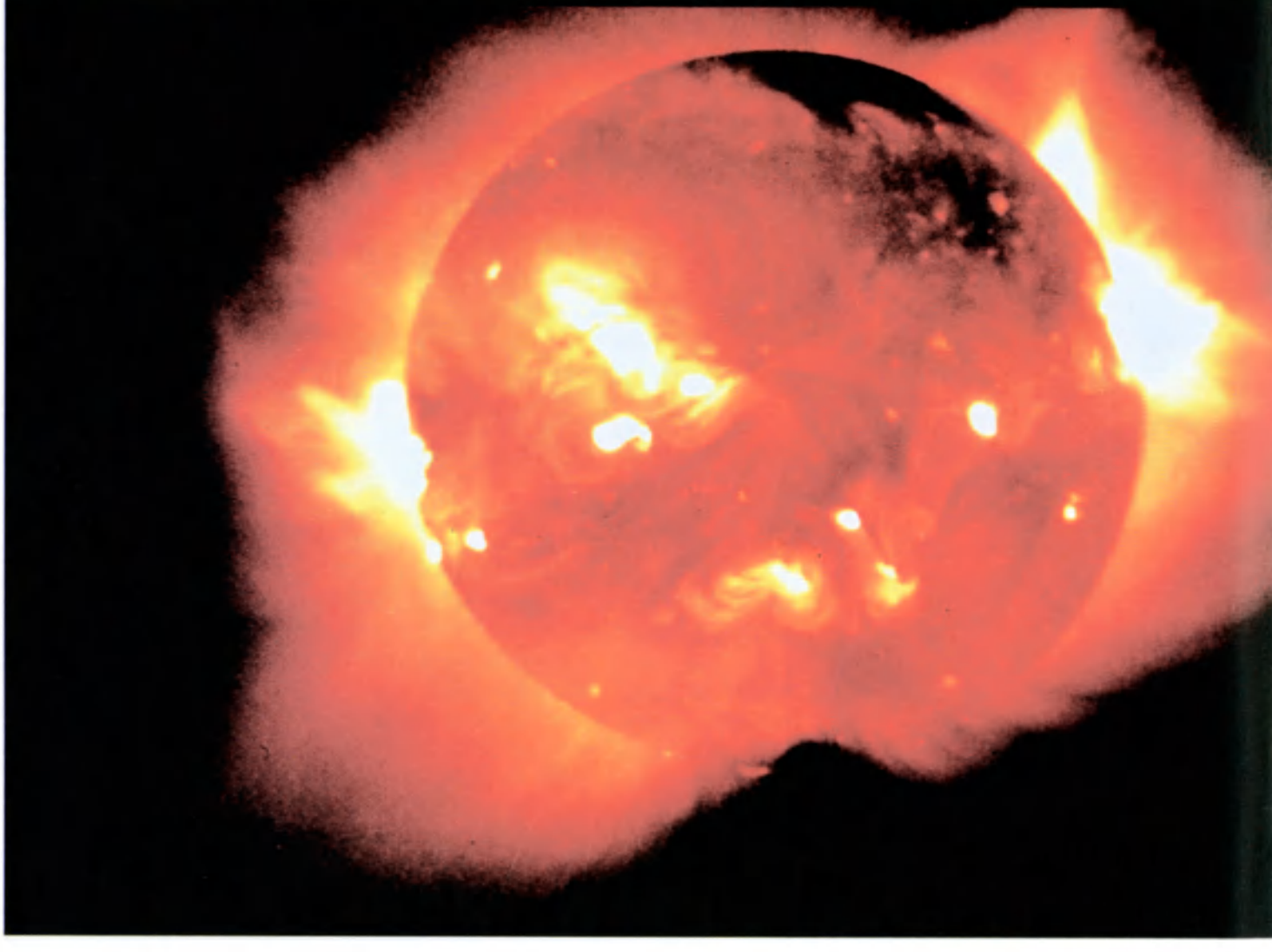
■ **Tolerance, in other words?**

"Tolerance" is the word. But unfortunately it often sounds like an impossible dream. ■

SERAFÍN GARCÍA IBÁÑEZ is a journalist with UNESCO's Office of Public Information.

Our middle-aged neighbouring star

by Pierre Lantos



An X-ray image of the sun taken by satellite showing the activity of the corona, the outer layer of the solar atmosphere. The corona is formed by gas at very low density but an extremely high temperature (1 to 5 million degrees Kelvin). The brightest areas are active regions where sunspots would be seen in visible light. The darkest regions are coronal holes from which a stream of charged particles is ejected into space.

PIERRE LANTOS, of France, is a research director at his country's National Centre for Scientific Research (CNRS) and an astronomer at the Paris-Meudon observatory. He is the author of *Le Soleil* (Paris, 1994).

Once upon a time there was a vast empty space within our galaxy, nearer to the edge than the centre. We should probably never have known anything about it had it not become the birthplace of a star—our sun. For the space was not entirely empty; it contained an enormous cloud of hydrogen molecules and particles of dust. This cloud became unstable, then collapsed and broke up into smaller and smaller clouds. Our sun and its planets were born of one of these tiny clouds.

When such a cloud collapses under the effect of its own weight, a lot of energy is released, and the surrounding temperature—at first only a few dozen absolute degrees—rises and eventually reaches several thousand degrees. Contraction comes to an end when the star's core temperature reaches a million degrees and nuclear reactions begin. Tens of millions of years elapse between the time when the hydrogen cloud begins to destabilize and the birth of the adult star. This is a very brief youth for a star like the sun whose life will last for ten thousand million years or more.

A nuclear furnace

When they tried to explain the origin of solar energy, nineteenth-century astronomers advanced three hypotheses: that it was due either to chemical reactions, to the contraction of the star or to meteorites falling into the sun. By the end of the century the most lucid of them had

The sun is actually a middle-aged star. But even though half its life is over, there's no cause for alarm. The heavenly body that gives us light still has a bright future ahead of it.

realized that none of these processes could supply the energy the star needs over a very long period. The great experimental and theoretical discoveries made in the first half of the twentieth century revealed that solar energy is actually produced by nuclear fusion reactions that convert hydrogen into helium. These reactions take place in the core of the sun where 700 million tons of hydrogen are changed into helium each second and four million tons of matter are transformed, as Einstein showed, into energy.

Today several experimental methods can be used to investigate the opaque interior of the sun. One of them consists of studying the elementary particles known as neutrinos that are released by the fusion of the gas nuclei and are capable of passing effortlessly through the whole volume of the sun. But although the neutrinos are very speedy messengers, the energy released by nuclear fusion in the central part of the star takes some ten million years to reach the surface, moving centimetre by centimetre in a random fashion. It finally appears in the form of light, an immense source of life for our planet.

Right, computerized false-colour photo of a giant cluster of sunspots. The picture was taken a few months before maximum in the 11-year cycle of solar activity.

Above right, Aurora borealis, the northern lights, photographed over spruce trees near Fairbanks, Alaska (United States). These luminous displays appear in the night sky at high northern latitudes when charged subatomic particles from the sun interact with atoms and molecules in the earth's upper atmosphere.

Spots and flares

The main observable phenomena on the sun's surface are sunspots, which are darker than the rest of the disc. In Antiquity some observers saw them with the naked eye. They are signs of the sun's magnetic field, which, created deep inside the star, structures its entire atmosphere. When, during a total eclipse of the sun, the extended part of this atmosphere—the corona—can be observed, it is clear that the solar atmosphere is not uniform.

Above the spots, in the solar corona, the magnetic field can stock energy and suddenly release it. Solar flares which occur frequently in weak form can nonetheless have a strong

In the core of the sun 700 million tons of hydrogen are changed into helium each second and four million tons of matter are transformed into energy.

disturbing influence on the interplanetary environment. Like the spots that produce them, they follow an eleven-year cycle, which is due to the oscillation of the mechanism creating the magnetic fields inside the sun. When solar activity is at its height, the earth's space environment is bombarded with a shower of highly destructive protons emitted during flares, interplanetary shock waves, and an increase in ultraviolet rays and X-rays that are thousands of times more intense than when the sun is calm.

At such times satellites have a higher rate of breakdowns and their orbits are greatly disturbed. Astronauts travelling to the moon or to other planets would be in serious danger of radiation during a big flare. On the earth's surface, we are well protected from the sun's caprices by our planet's atmosphere and magnetic field. It should be noted, however, that on rare occasions particle emissions from the sun may disturb the earth's magnetic field, as can be seen by an increase in the northern lights, and have severe effects in telephone and computer cables and electricity distribution grids. During flares, radio communication may also be difficult, and even impossible, in certain regions.

As already noted, the sun will live to an age of some ten thousand million years. At 4.5 thousand million years old, it is now in middle age. It will continue to burn its hydrogen for about the same amount of time and remain stable. But then, in its last thousand million years, the sun will dilate, and its surface temperature, around 5,800°K at present, will be reduced by half. It will then become what astronomers call a "red giant", i.e. it will be at least fifty times bigger and 300 times brighter than it is today. Life on earth will become infernal. Then, lacking fuel, the sun will shrink and lose its brightness, ending up as one of the ghost stars that wander through the universe.

So, in five billion years, "Stop the world, we have to get off". ■

Artist Julian Baum's striking portrayal of the sun as it will appear near the end of its life in around 5,500 million years. It will evolve into a red giant, 300 times brighter and 50 times bigger than it is today.

Myths with the sun in them

by Philippe Borgeaud

Pharaoh Akhenaton making an offering to Aton, the solar disk (about 1353 B.C.). The name "Akhenaton" (literally "he who pleases the solar disk") was adopted by Amenophis IV at the beginning of his reign as part of his religious and political reforms.

From ancient Egypt to the Aztecs, from the Amazon to the Baltic, the sun has always played a leading role in mythology and tradition

In the religious universe of Ancient Egypt the sun was the core around which everything revolved. The Egyptians attentively watched the sun's daily round, which they represented in the form of a scarab indicating the future, and later as the resplendent solar disk, but devoted even more attention to describing its nightly course, during which the sun god, Re, was joined by his earthly son, the pharaoh, when the latter died. Travelling every night

through the underworld in his boat, Re had to face trials and defeat hostile forces, especially attacks from Apepi, a giant snake. For the sun, dawn was equivalent to rebirth.

The eye of Re

One of many Egyptian traditions concerning the sun was that of the revolt (or plot) of men. When Re, as lord of the earth, grew old, he consulted the gods and made up his mind to despatch against the plotters the lion-goddess Sekhmet ("the powerful"), who was also his eye (this personification of the solar eye reflected the sun's omnipotence). The gods did not intend to wipe out human beings, simply to reduce their number. But Sekhmet, consumed with rage and drunk with blood, lost all self-control. To calm her down and prevent her from massacring all humanity, Re thought of an antidote. He poured out a large quantity of beer that he had dyed red. The lioness drank it and became so drunk that she forgot her fury. Humanity was saved, but the goddess remained angry. Eventually Re became weary of humans and decided to leave the earth. He climbed onto the back of Nut (the celestial Cow) and rose into the sky.

Other stories in the same mythological cycle tell how Re's eye, in the form of a lioness named Tefnut, went into exile in deepest Nubia. The sun god was thus deprived of his eye, and as a consequence the whole country was engulfed in chaos. The gods had to send emissaries to mollify the terrible goddess and encourage her to return, a task that was finally accomplished by Thoth, a clever baboon. The goddess turned herself into a cat (Bast), or became Hathor, goddess of amorous desire. To everyone's delight she returned to Egypt.

Taperet with raised hands worshipping the Egyptian sun god Re-Horakhty. Painting on wood, ancient Egypt, 9th century B.C.

The five suns

In Aztec tradition, as recorded in such accounts as the *Leyenda de los Soles* ("Legend of the Suns", written in Nahuatl in 1558 after the Spanish conquest), our sun was preceded by four other suns, corresponding to four different epochs.

The first sun or "Four-Jaguar" shone at the time when the earth was inhabited by giants. It was buried when the sky collapsed and, under cover of dark, the jaguars devoured everyone in the world. The second sun, "Four-Wind", was destroyed by a great hurricane that turned people into monkeys. The third, "Four-Rain", was obliterated by a rain of fire that turned people into turkeys. And the fourth, "Four-Water", ended in a deluge that drowned the mountains and transformed human beings into fish. Only a single couple escaped, protected by Tezcatlipoca, god of the night sky, but they made the gods angry and "Tezcatlipoca cut off their heads, stuck them onto their rear-ends and turned them into dogs".

The fifth sun (our own), known as "Four-Movement", is also under threat and condemned to eventual destruction by earthquakes and widespread famine. Humankind must put off this evil day by keeping the sun supplied with energy. Human sacrifice is necessary to fuel the sun and keep the world alive. The myth of the fifth sun's birth was therefore also a founding myth of ritual sacrifice among the Aztecs.

The most famous version of this myth is that told by the sixteenth-century chronicler-monk Bernardino de Sahagún in his *Historia general de las cosas de Nueva España* ("General History of Things in New Spain").

Bernardino de Sahagún tells how the gods gathered in Teotihuacán, an ancient Central American city, and asked, "Who will be responsible for lighting the world?" One of them, Tecciztécatl, immediately volunteered. Then the gods asked, "Who else?" But no one else dared to volunteer for this task. The inconpicuous Nanahuatzin, who was afflicted with *bubas* (pustules), sat silently apart from the rest. They turned to him and said, "Let it be you, little *buboso*". "I accept as a favour what you ask me to do," he answered. "So be it."

The two gods began by doing four days of penance. Then they lit a fire on a stone that is known today as Teotexcalli ("the divine rock"). Everything offered by Tecuciztécatl was precious: instead of palm fron`ds he offered rare

Left, *The Sun Stone* (basalt, 3.35 metres in diameter, 24 tons, early 16th century). At the centre of this huge circular disk, sometimes called "the Aztec Calendar", the fifth sun of Aztec mythology is shown with human features.

Below, the Sun Pyramid, the largest of the ceremonial buildings in Teotihuacán, some 40 kilometres from Mexico City. A pre-Columbian metropolis, Teotihuacán flourished between 250 and 650 A.D.

feathers; instead of bales of hay he offered balls of gold; instead of maguey thorns, precious stones; instead of bloody thorns, bunches of red coral; and last but not least, high-quality copal. Nanahuatzin, on the other hand, offered instead of palms nine green reeds that he tied together three by three, hay and maguey thorns anointed with his own blood and, instead of copal, the scabs of his own *bubas*.

At midnight the gods formed two lines, one on each side of the place where the fire had burned for four days. Tecuciztécatl and Nanahuatzin took their places with their faces turned toward the fire between the two rows of gods who remained standing. The gods turned first to Tecuciztécatl and said, "Come, Tecuciztécatl, cast thyself into the fire!" But the fire was terribly hot, and however hard he tried he became frightened and drew back. And so the gods turned to Nanahuatzin and urged him to try instead. Without the slightest hesitation, Nanahuatzin threw himself into the flames and began to burn at once. When he saw that, Tecuciztécatl also threw himself into the fire.

When the two gods had been consumed by the fire, the others sat down and waited for them to reappear. After a long time, the sky turned purple, and the earth was flooded with light. It is said that the gods knelt down in order to see where Nanahuatzin would arise now that he had become the sun, and that only a few of them predicted correctly. When a very red sun rose languidly in the east, no one could look at it because it was blinding in its magnificence, and rays burst from it in all directions.

The love of Etsa and Nantu

A myth of the Jivaros Indians of the Amazon tells how Etsa, the sun, is the son of the Creator, who blew mud onto him while he was sleeping. The mud became a woman, the moon (Nantu), with whom the sun wished to couple. But Nantu was frightened and did not respond to Etsa's advances. Taking advantage of a moment when Etsa was concentrating on painting his face to make himself more attractive to her, she flew like an arrow to the upper world, where she too painted her face, but with black lines, before clambering up into the heavenly vault like a jaguar.

Etsa tied two parrots and two parakeets to his wrists and knees and flew up to Nantu. A violent dispute broke out between them. Consumed with anger, Etsa struck Nantu, creating an eclipse of the moon. Then Nantu got the upper hand, causing an eclipse of the sun. The outcome of this quarrel, which was destined to break out again, was the moon's submission to the sun. Defeated, Nantu cried, and her face

Two Greek relief depictions of Helios, the sun god, wearing a radiant crown and driving the heavenly chariot.
Left: 3rd century B.C.
Above: 4th century B.C.

became red, which is why a red moon always announces rain.

Finally Etsa and Nantu married and coupled on the banks of the Kanusa river. Pregnant by the sun, the moon swelled and gave birth to a child, Uñushi (the "Sloth"), ancestor of the Jivaros. Uñushi soon had a whole string of brothers and sisters, including the freshwater dolphin, the peccary and above all a young woman named Manioc, the boon companion of the Jivaros.

Lady Sun and Lord Moon

The traditional poetry of the Baltic countries also contains a rich corpus of stories about the sun, moon and stars.

In one popular Lithuanian song, Moon (masculine) and Sun (feminine) are a divorced couple. They separated because the moon betrayed the sun with the morning star. Perkunas the thunderer punished the guilty husband by slashing him with a sword, thus giving rise to the phases of the moon.

Such stories are probably the extensions of very ancient cosmological traditions. A Christian missionary whose story was recorded in the fifteenth century tells how a tribe in this region venerated a huge iron hammer. He was told by a pagan priest that Lady Sun, formerly locked away in a tower by a local tyrant, was delivered by the signs of the Zodiac, which used a huge hammer to demolish the keep.

In old Icelandic mythology (the *Gylfaginning* or *The Beguiling of Gylfi*, the first part of the *Prose Edda*, written by Snorri Sturluson in the thirteenth century), Mani (masculine, Moon) is the brother of Sol (feminine, Sun), and both are the children of Mundilfari ("He who drives time"). Moon and Sun rush across the sky, never slowing down, she in front, he behind, each with a monstrous wolf snapping at their heels.

At the end of time the wolves will catch them up and eat them. The stars will disappear, the mountains will crumble, the oceans will invade the land, and gods and men will perish. But there will be survivors, including a small number of gods and a human couple fed by the morning dew, in a green and lovely land that will rise from the sea. Sun's daughter will continue her mother's path over the fields, which will produce harvests without having to be ploughed.

Helios and his heavenly chariot

In Greek mythology Uranus (Starry Sky) and Gaea (Earth) formed the first union in a world where nothing existed but Abyss and Desire, and gave birth to the Titans, who were gifted with enormous but ill-defined power. Two of the Titans were Hyperion ("he who circulates in the heights") and Thea (the "divine"). This first generation of sexed offspring is similar to that of Night, a daughter who sprang fatherless from the Abyss (Chaos). Uranus prevented his offspring from emerging "toward the light" and hid them in the body of Gaea, with whom he continued to couple "by bringing the Night". Gaea appealed to her children for vengeance and gave a weapon to her youngest child, Cronus, who cut off Uranus' genitals, thereby separating heaven and earth.

In the following generation Helios the sun-god, brother of the Moon and Aurora, and a contemporary of Zeus and the Olympian gods, was said to have issued from the love between Hyperion and Thea. He reproduced in luminous fashion the divine quality and the heavenly course of his titanic parents.

Helios was a wonderful charioteer. By day he drove his chariot drawn by winged horses from east to west across the sky as far as the banks of

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the stream of Ocean whose regenerating waters girdle the earth. There he embarked in a large hollow cup or cauldron and sailed through the night to the dawn over Ocean's stormy waves.

The daughters of Ocean were Helios's companions. From their union sprang strange and fearsome children, including Circe the sorceress, who lived on the western isle of Aeaea (located near Italy, according to the Odyssey legend) and Aeetes, the king of Colchis, a land located at the foot of the Caucasus on the shores of the Black Sea. Aeetes was the father of another famous sorceress, Medea.

Helios was an ideal observer of men and gods, a spy in the service of his cousins the Olympians. Nothing escaped him, not even the kidnapping of Demeter's daughter Persephone by Hades, lord of the underworld. Yet he lived sheltered from the problems of the Olympian gods. If he was slighted, others would avenge him. Thus Odysseus' companions in the *Odyssey* insult Helios by killing and eating part of his flocks. Helios asks Zeus for reparation, and Zeus punishes the evil-doers by making them die in a shipwreck at sea.

Nothing must disturb Helios's calm transcendant regularity. One day, his son, Phaethon (the "radiant") asked his father to let him drive the sun chariot to prove his own divinity. Not possessing his father's skill, the young man drove too close to earth and scorched it, whereupon Zeus smashed the impudent boy with a thunderbolt and hurled him into a river. Helios did not even have time to mourn, leaving that to Phaethon's sisters, the Heliades, whose tears became drops of amber, the physical expression of a sun-caused sorrow.

It took an utterly wicked crime to make the sun sufficiently upset to deviate from its course. It was committed by Atreus, who killed the children of his twin brother Thyestes and then served up portions of their cooked bodies to their father at a banquet. When Thyestes had eaten, his brother showed him his children's heads and told him what he had just eaten, whereupon Helios turned back on his course in horror. ■

Thinking in images

The supernatural and the fantastic are characteristic features of myths, in which animals sometimes have the power of speech, human beings may change into animals or plants, and gods and heroes wield fantastic powers.

The liberties that myth takes with reality do not represent a breakdown of the rules of reason. The world's components are seen as raw material from which a story can be constructed; real things become tools—images—whereby a story can become a vehicle of meaning.

What the French anthropologist Claude Lévi-Strauss called "the savage mind" is capable of thought as rigorous as that of philosophers or mathematicians. It is a mind that functions with the aid of elements of the real world. It does not focus primarily on that world but thinks with the help of it. It is therefore not surprising that some of the images that crop up in myths recur in many different places and historical periods. This does not mean, however, that they are always and everywhere endowed with the same meaning.

Among these recurrent images are those linked with celestial light: the sun, the moon, the planets and the constellations. The sun is an essential item on this list, prompting, as it does, thoughts of the beginning and the end of things, and of the daily victory of light over darkness and nocturnal anxieties. As it undergoes the great changes in intensity that mark its course from one horizon to the other, from dawn twilight to high noon and back to evening twilight, the sun indicates spatial directions as well as dividing up stretches of time. Above all it makes things visible. It brings light as well as heat. Very often it is regarded as an eye and an observer, in line with the very ancient and widespread notion whereby an eye illuminates the thing it sees. Such is the case of the eye of that fearsome arbiter the Egyptian sun-god Re, and that of the Greek sun-god Helios, which nothing escaped.

P. B. ■

Above, dancers wearing sun and moon masks at the feast of St Peter and St Paul in Sibayo, southern Peru.

Above right, in a Japanese ritual dance the Shinto sun goddess Amaterasu ("radiant heaven") emerges from the cave in which she had taken refuge, thereby plunging the world into darkness.

Right, a modern Druid ceremony at Stonehenge in Wiltshire (England). The exact purpose of this group of megaliths, the largest in the British isles, is not known, but according to one theory it was a temple of the sun.

A light that shines through time and cultures

by Madanjeet Singh

Left, *Coronation of the Virgin* by the Italian painter Fra Angelico (1400-c. 1455). Below, anthropomorphic rock carving of the sun god at Saimaly Tash in the Tien mountains of Kirgizia. Bronze age (4000-2000 B.C.).

After their emergence as tool-making hominids about one-and-a-half million years ago during the Old Stone Age, our prehistoric ancestors instinctively related the sun to all-embracing nature—stones, mountains, trees, plants, flowers, birds, beasts, water and fire. Living in caves or beneath overhanging rocks, they used wooden sticks and unpolished chipped stones for hunting wild beasts, and depicted hunting scenes and solar symbols in rock carvings. Such petroglyphs have been discovered in central Asia, Africa, Europe and in other parts of the world as far distant as Indonesia and southwest America. They show the sun in a variety of forms, either as rays emanating from a circle or anthropomorphically, as a nimbus surrounding a head.

These rudimentary circular and spiral patterns are thought to have led to the earliest forms of hieroglyphic writing, the invention of the wheel, and the universally popular spiral design, as well as to the image of the halo as a sign of spiritual luminosity. In time almost all elements of nature became deities and totems of sun cults and were represented in human or animal forms, forming the basis of organized religions that invoked the sun as the divine light of virtue. "Sûrya is the ultimate truth," states *Aditya-Hrydya Sûtra*, and this is beautifully depicted in an Indian miniature painting, *Heart of Sûrya*, in which Vishnu and his consort Lakshmi are seated in the sun, much like the beautiful figure of Mani (216-274 A.D.), the founder of Manichaeism, in the still-used temple of Cao'an on the eastern coast of China near Quanzhou in Fujian province. In the *Samyutta Nikaya*, the Buddha calls the sun "the fiery heart, my kith and kin", and this concept is also incorporated in Christian art, as can be seen in Fra Angelico's painting *Coronation of the Virgin*, now in the Uffizi (Florence).

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People have always venerated the sun as an emblem of life, truth, justice and wisdom

Right, a sacred feast of Roman initiates in the cult of Mithra (2nd century A.D.). Worship of this Indo-Iranian divinity with solar associations inspired a major religious movement, Mithraism, in the Roman Empire between the 1st and 3rd centuries A.D.

Left, inside a painted cave-temple at Dunhuang (China). The prophet Mani is shown with Fu-xi and Nu-wa, the sun and moon deities (6th century A.D.).

Prophets

Prophets such as Zoroaster (late seventh and early sixth centuries B.C.) and Mani invoked the sun's divine light of virtue to conquer the darkness of evil. The sun god Mithra became the charioteer of Ahura Mazda, the Zoroastrian Creator God of Light, who is opposed by the evil darkness of Angra Mainyu or Ahriman. Ahura Mazda is "like the sun to behold—for the sun is the greatest of all visible, earthly fires", stated Zoroaster (c. 628-551 B.C.). Even today in several eastern Iranian languages the word for the sun is simply "of Ahura Mazda". Manichaeism was truly an ecumenical faith embracing all people, as Mani, its founder, tried to integrate diverse religions such as Gnostic Christianity, Zoroastrianism and Buddhism, in a strongly dualistic philosophy based on the eternal struggle between good and evil, light and darkness. It was once professed by many peoples, from Spain in the west to the eastern coast of China.

Parsees, whose name is derived from *Parsa* or Persian, are Indian followers of Mazdaism (Zoroastrianism) who live in the Bombay area. They have temples in which the sacred fire is kept burning perpetually. Left, the Parsee *yasna* ceremony in which fire is propitiated as one of the seven creations, along with water, plants, animals, humans, the earth and the sky.

A symbol of power

Above, the sun chariot in the Apollo fountain in the grounds of the Château of Versailles (17th century). It has been suggested that the charioteer's features are those of France's Sun King, Louis XIV.

Great conquerors and rulers employed the spirit of solar universality in order to ensure the loyalty of their subjects. Confronted with antagonistic sects which engendered social tension, ethnic hatred and religious animosity, they tried to create stable government based on norms of unity symbolized by the sun.

Akhenaton (c. 1353 B.C.) sought to unite his people under the all-embracing light emanating from the sun-disc, the Aton. Alexander the Great (356-323 B.C.) aspired to rule the world "like the sun", especially after his conquest of Egypt, when he chose to become the "son of the Sun-God Amon". The Mauryan emperors in India were inspired to emulate the example set by Alexander's brief incursion into India in 326 B.C., which helped to revive the ancient sun-related Vedic concepts. Chandragupta Maurya (c. 321-297 B.C.) cast himself in the "sun-guardian" image of Universal Emperor, and Ashoka (d. 238 B.C.?), the last major emperor of the Mauryan Dynasty, erected numerous pillars inscribed with sun motifs. The Roman emperor Aurelian (215-275 A.D.) sought similarly to bring divergent sects and tribal minorities in his empire under the aegis of the Unconquerable Sun (*Sol Invictus*). The "Divine Sun" was at the centre of the syncretic Din-i-Ilahi cult, around which the Mughal emperor Akbar (1542-1605) tried to rally the diverse peoples of his vast Indian empire.

Louis XIV (1638-1715), the "Sun King" of France, glorified the myth of Apollo, and often appeared dressed as this sun deity at the lavish feasts he organized in the vast gardens of his great palace of Versailles. A sculpture of Apollo stands in the grotto of Thetis at Versailles, and elsewhere in the gardens a figure of the sun in a chariot is said to represent the king.

Left, medallion depicting Cybele, the mother-goddess of ancient Greece. Combining Greco-Roman, Mesopotamian, Persian and Indian art styles, it was inspired by Alexander the Great (356-323 B.C.) who wished to rule "like the sun".

Below, a composite solar symbol inspired by several cultures, this capital adorned with lions is from a commemorative pillar erected in Sarnath (India) during the reign of the Emperor Asoka (3rd century B.C.).

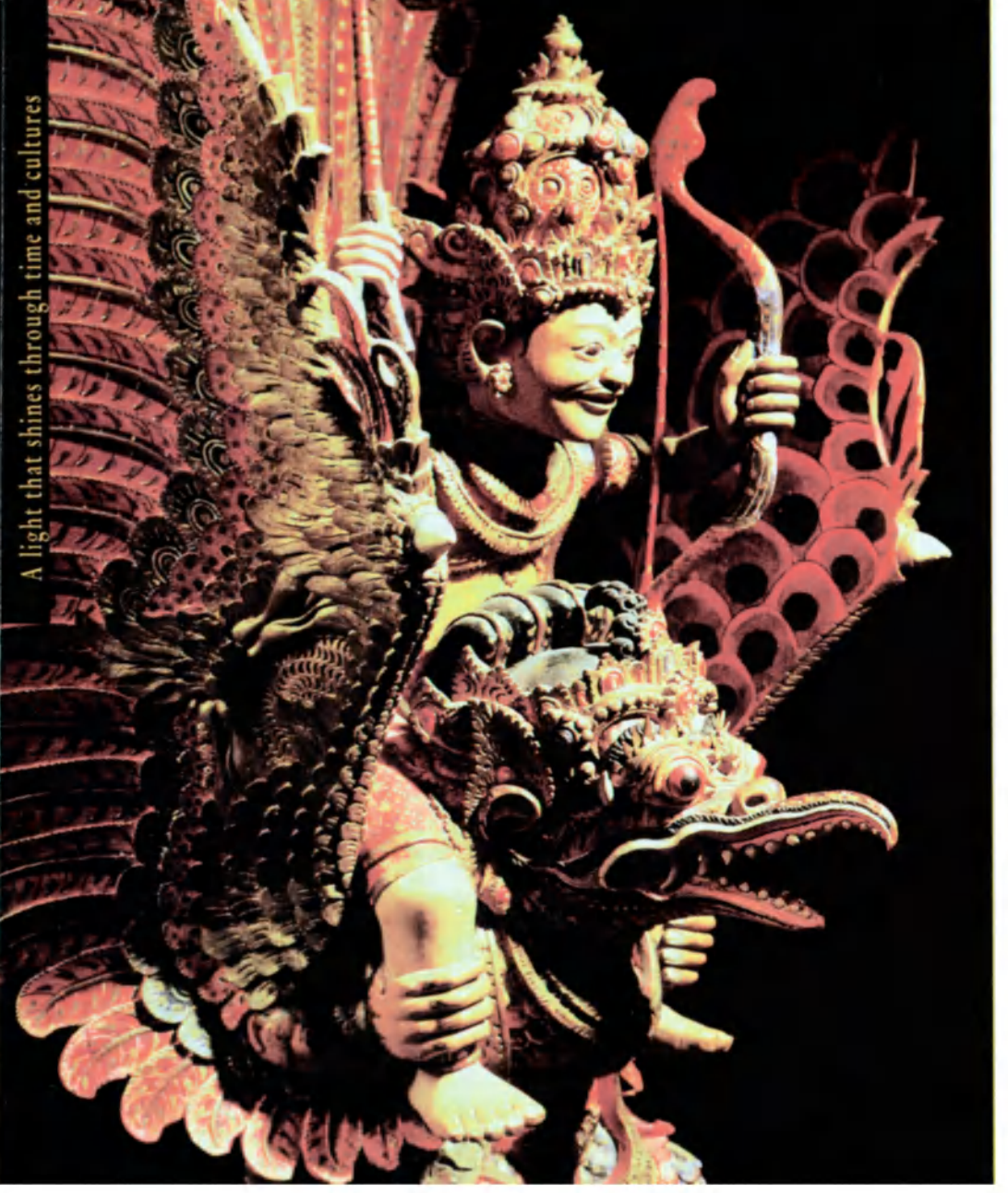
Mountains

The mountain often became the "heavenly ladder" needed to reach heaven where the sun god and other solar deities supposedly lived. In Egypt the notion of "the ladder of Horus" (the sky-god) reaching to the sun-door, the crossing point from mortality to immortality, seems to have originated in very early step pyramids. In Mexico the Aztecs related the Teotihuacán pyramids to the sun and the moon. Shamash, the sun god of the Semitic pantheon, rose from the eastern mountains and inaugurated the practice of building elevated citadels like the ziggurats to the Babylonian moon-god Nanna. Pausanias, a Greek traveller in the second century, relates how he saw sun altars of worship on the highest acropolis at Corinth. The mountain at Bojonegoro in Java is venerated because "the sun comes out of it", and in Sri Lanka, Saman "the deity of the morning sun" is worshipped on Samanolakanda Mountain, also called Adam's Peak. The Chinese Emperor Wu-di of the Han Dynasty (140-87 B.C.) frequented the Cheng mountain at the eastern end of the Shandong peninsula in order to worship the sun rising from the sea. The mountain deity of ancient Japan, Yama-no-kami, is worshipped as "the sun of forests and animals".

Joined by a rope, these two rocks off the seashore at Futamigaura (Japan) symbolize the primordial divine couple. The sun-door of life stands on top of the larger rock.

A religious structure of Babylonian origin, the ziggurat was probably both a symbol of the primeval mountain and the meeting point between heaven and earth through which the gods passed. Left: an illustration from an early 20th-century German book showing the ziggurat of Babylon.

Below, the pyramid temple of Kukulcán, today known as the Castillo, at Chichén Itzá, Yucatán (Mexico). (Post-classical period, 950-1500 A.D.)



This painted wood carving from Indonesia, left, shows the Hindu god Vishnu riding Garuda, the giant eagle and king of birds, on which he flew to his imprisoned mother's aid.

Below, cover of a Russian émigré magazine, published in Berlin in 1921-1922. Its title, *The Firebird*, is that of a famous Russian folk tale.

Birds

The mythical sun-bird depicted on the gateway of a 17th-century monument in Bukhara (Uzbekistan).

Birds flying in the sky naturally became identified with the sun. In central Asia this tradition goes back to the Old Stone Age, and is notably exemplified by the petroglyph of a strange bird depicted, with other sun symbols, in the Shakty cave in the Pamir mountains. The mythical fire-bird of Russian folklore was endowed with extraordinary powers: "even one of its feathers could flood the whole world with the sunlight of happiness". In ancient Egypt, a fabulous bird known as the *bennu*, a kind of heron, was traditionally associated with sun worship as a symbol of the rising sun and of life after death. It was also known as the phoenix, and its image appears on the coinage of the late Roman Empire as the symbol of the Eternal City. The Chinese name for it is *pheng* or *ch'i-lin*, and in Islamic mythology it is called *rukh oranqâ* (Persian *sîmorgh*). Garuda is its counterpart in India and southeast Asia.

The depiction of the sun in animal form results largely from ancient beliefs in which birds, animals, reptiles and fish were assigned special significance. Perhaps the earliest known representation of a bird is the eagle/falcon image on the palette of King Narmer from Hierakonpolis (c. 3,000 B.C.), symbolizing the sun god Horus.

A leitmotiv of art

An African sun mask.

Art styles throughout history have also been inspired by the sun, from the Amarna sculptures in ancient Egypt to the Impressionist art forms of modern times. With his emphasis upon *maat*, or truth, Akhenaton created the first-ever "realistic" artistic style, ordering artists and craftsmen to depict faithfully what they actually saw rather than follow tradition-bound canons glorifying the Pharaoh's personality.

During Akbar's time a distinctly Indian style of painting was inspired by his "solar vision". It is characterized by a vivid treatment of the physical world which can be seen in the celebrated manuscript which Akbar ordered his artists to prepare of *Hamza-nama* (c. 1567), the story of the deeds of a legendary adventurer who lived during the reign of Harun ar-Rashid.

The shining spirit of the sun also inspired Japanese painting. The imperial edicts of the seventh and eighth centuries which formed the basis of Japanese political, legal and ethical values refer repeatedly to "the sun's bright, pure, honest and sincere heart," and these virtues were also incorporated into the realm of aesthetics, so that purity, directness and brightness became the essence of Japanese art and literature. The pervasive influence of the sun in Japanese culture is evident in *haiku* poetry, calligraphy and ink-drawn scrolls, as well as in the tea ceremony, flower arrangement and garden design.

"The Triumphal Procession of the White Horse", an episode from the legend of Akbar, Mughal emperor of India (1556-1605), is depicted in this 16th-century Indian miniature.

Inside a yurt or tent of the Kalmyks, a traditionally nomadic people of Mongolian origin who live in Siberia and central Asia. Early 19th-century French lithograph.

Below, the Roman town of Bram in the southwest of France was built in the 4th century A.D. according to a "solar" plan.

Architecture

In the field of architecture, it is amazing how the simple sun motif in the shape of a small circular opening in the roof of a nomadic yurt developed into as grand and marvellous a structural source of illumination as that seen in the dome of the Pantheon in Rome and its rotunda. Apparently the Roman baths and similar structures built to serve as tombs for pagan emperors were also "glorified yurts". It was not until the fourth century that a Christian meaning was given to light-oriented architecture in the baptisteries and funerary chapels attached to basilicas. The manner of orienting pagan shrines towards the sunrise was also adopted by Christian churches, built with the altar located at the east end or more accurately in the direction where the sun rose on the feast day of their patron saint.

The sun inspired the circular urban plan which encircles the central shrines in many medieval towns in Europe, one notable example being the Roman town of Bram in France (founded in 333 A.D.). These towns recall the ancient Zoroastrian townships in Central Asia, which were conceived either on a circular design or in the shape of a crossed circle.

Pageants and festivals

Most pageants and festivals around the world can be traced back either directly to the sun or indirectly to it through agricultural and fertility rites. Processions involving animal and reptile solar symbols in many Asian, African and native American societies also have equivalents in Europe. The once-popular giants' carnivals in Douai and Dunkirk in France and Antwerp in Belgium, actually originated in sacrificial rituals of ancient solar cults, in which huge osier frames of greenery were carried—much like the Jack-in-the-green-basket-clad figures in English May Day parades (which are essentially fertility celebrations). Christians in Wales adopted another pagan ritual of fertility and conception in which the link between the sun and water was invoked by "walking-sun-wise" around a holy well three times.

Above, a sun mask worn at the Venice carnival.

Zoroastrianism and the cult of fire

by Mahin Tadjadod

'Fire must play the same role on earth as the sun does in the sky'

A product of the Indo-European tradition, the cult of fire was practised in ancient times by the Scythians and was also known to the Greeks and Romans. An eternal flame burned on the altar of Pan at Olympia, the Greeks kept a gold lamp permanently in the sanctuary of Pallas Athene, and the Persian king Xerxes I (486-465 B.C.) of the Achaemenid dynasty is said to have spared the temple of Delos because its cult reminded him of the fire of Iran. (In India and Iran fire was the dominant feature of the ancient Aryan religion.)

The prophet Zoroaster transposed fire to the spiritual realm as a symbol of divine splendour and power, the source of human life and love for Ahura Mazda, the "Wise Lord". Strictly speaking, fire was never a divinity in itself, but rather the visible sign of God's presence. Mazdaism (another name for Zoroastrianism) is based on a strong affirmation of the oneness of Ahura Mazda, whose essence is consubstantial with infinite light. Ahura Mazda's eye is the sun, and his son is fire, burning before him in his spiritual form.

A FLAME KEPT ALIGHT FOR 3,000 YEARS

The *Bundahishn* ("Book of the Original Creation") speaks of the "three fires of Persia" that long wandered where the wind blew them before descending from heaven at the time of the mythical Kayanid kings. According to one theory they are linked to the three social classes instituted by Zoroaster's three sons: priests, warriors and farmers.

Since then the flame has never gone out in the temples. At night it is put to sleep with prayers and at dawn it is awakened with praise.

Fire rewards and punishes. It is the symbol of sincerity and purity. It burns the sinner and protects the virtuous. Trial by fire, the Ordeal, decides whether a person accused of a crime is innocent or guilty. Falsely accused of having raped his mother-in-law, Siyavosh, the hero of the Iranian epic, the *Shah-nama* ("The Book of Kings"), passes through fire and emerges unscathed. Since he is stainless, he is spared by the fire.

Even today the Zoroastrian community obeys these ancient precepts. Its faithful still make offerings to fire and are careful not to defile it with their breath. This is why Zoroastrian priests, the *mobads*, cover their mouths with the *panam* (two pieces of white cotton cloth knotted behind the head) when they face the fire and recite the *Avesta*, the holy book.

Today the faithful still come to the Zoroastrian temple at Yazd, the most venerable in all Iran. The building and the garden around it are carefully tended, and it is said that the fire burning inside has not gone out for 3,000 years. ■

MAHIN TADJADOD,
of Iran, is the author of several plays inspired by Persian mythology and epics.

Music

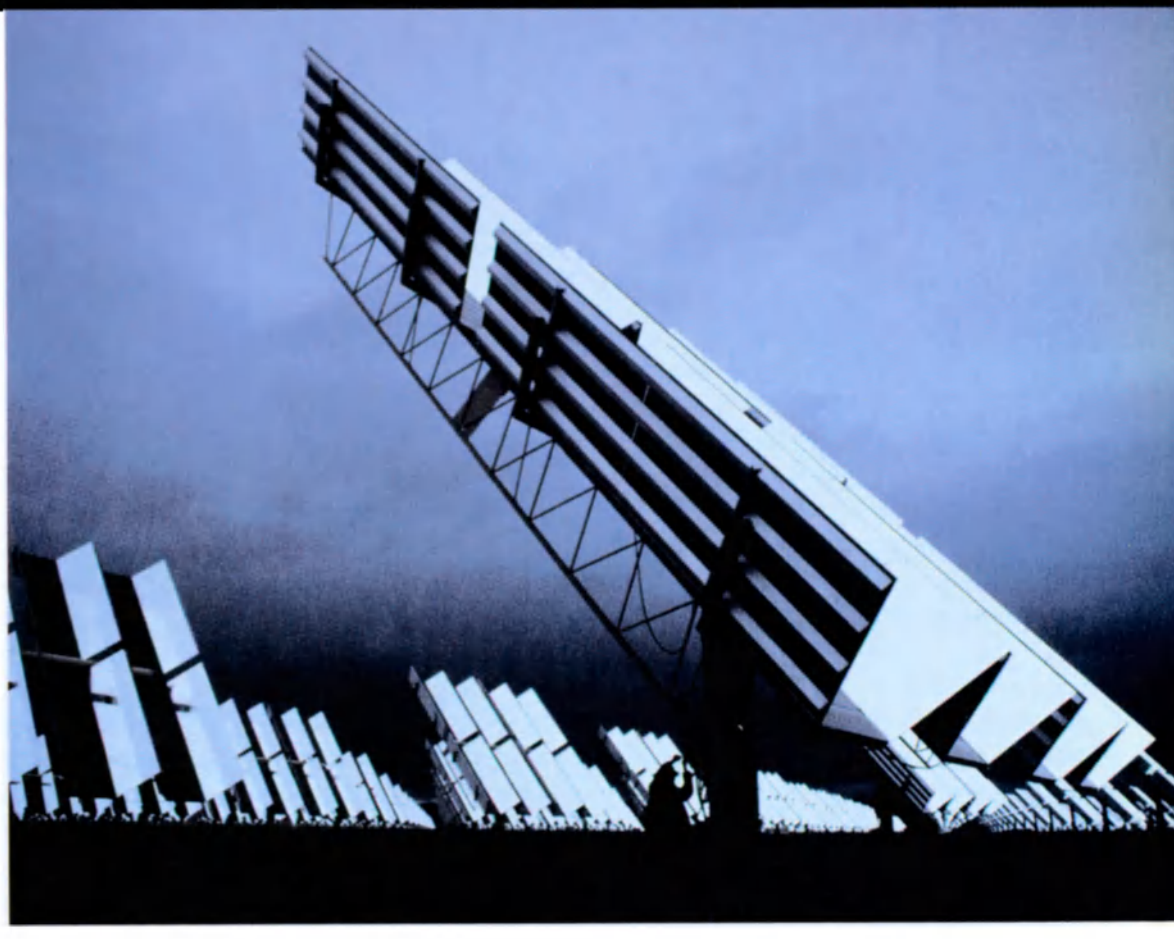
A tom-tom player (Sierra Leone).

The flute and drum are among the most ancient musical instruments. The flute, as a phallic symbol, is universally identified with the male, while the drum represents the female's womb. Together they symbolize the sun and hence fecundity, happy life, and rebirth. The flute and drum are in most cultures the principal accompaniment to sundances, which are generally performed with four dancers representing the four quarters of the universe. The flute's cosmic significance is also evident in Mozart's opera *The Magic Flute*, in which two "realms" are separated by light and darkness, and there is a struggle to possess the powerful Sevenfold Solar Circle—the sun. ■

Below, a scene from a 1991 Paris production of *The Magic Flute*. Sarastro, the high priest of the sun, stands before the Solar Circle.

Manolo plugs into the sun

by Christopher Flavin and Nicholas Lenssen



A unique and potentially revolutionary means of generating power, solar photovoltaic cells are meeting the energy needs of thousands of villagers in the developing world. One of them is Manolo Hidalgo...

Above, a solar energy power plant at Carrisa Plain, California (U.S.A.).

In Joba Arriba, a scattered farming settlement of about 5,000 people on the Dominican Republic's northern coast, Manolo Hidalgo decided to give his family a different kind of Christmas present in 1991: electric lighting. No longer content with dim and smelly kerosene lamps to light the homework of his three children, Hidalgo knew that his chances of getting electricity in the conventional way—by hounding government officials in the hope they would extend the nearest power line the necessary fifteen kilometres—were faint at best.

Hidalgo came up with a faster, more reliable option. Travelling to the nearby town of Sosua, he visited a small store called Industria Eléctrica Bella Vista, which offered a self-contained solar panel that converts the sun's rays directly into electric current. With help from the store's electrician, Hidalgo mounted the roughly one-metre-square panel on his roof and wired it to a lead-acid battery in order to store electricity for use in the evening. The day after visiting

A solar-powered water pump in a refugee camp in Hargeysa (Somalia).

Below, solar panel and water pump in a Moroccan village.

Sosua, his home had five working electric lights, as well as a radio and television set, all powered by his solar photovoltaic (PV) panel. With the flip of a switch on that December day, Hidalgo and his family joined tens of thousands of rural people who in the past few years have begun getting their power directly from the sun.

It is hard not to be struck by the irony that the basic energy needs of some of the world's poorest people are being met by what is arguably the most elegant and sophisticated energy technology yet developed. Indeed, solar photovoltaic cells, which can be used in everything from handheld calculators to suburban rooftops and large desert power stations, are a unique and potentially revolutionary means of generating power. Solar cell technology is advancing rapidly, and many experts expect the devices to be ubiquitous in the early part of the next century. But the greatest short-term impact of solar photovoltaics will be in the rural Third World, providing power to many of the more than two billion people like Manolo Hidalgo who do not yet have it.

Solar photovoltaic cells are semiconductor devices made of silicon—similar to but far less expensive than the chips used in computers—that convert the energy from sunlight into moving electrons, avoiding the mechanical turbines and generators that provide virtually all the world's electricity today. French scientist Edmond Becquerel discovered in 1839 that light falling on certain materials could cause a spark of electricity—known as the "photoelectric effect"—and that this charge could, under the right conditions, be propagated, forming an electric current. Within fifty years, scientists began to manufacture primitive solar cells out of a rare element known as selenium. The high cost and low efficiency of these devices made them useful in only one serious application—photographic light meters.

The precursors of the modern photovoltaic cells used on Manolo Hidalgo's roof did not emerge until 1954. Early that year, a small team of scientists at the Bell Laboratories in New Jersey began looking for a way to generate electricity for telephone systems in remote areas. As they tried to improve the selenium cells, a separate Bell team discovered that a silicon device

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This article has been extracted from their book *Power Surge, Guide to the coming energy revolution* (W.W. Norton & Company, New York and London, 1994).

More than 200,000 homes in Mexico, Indonesia, South Africa, Sri Lanka and other developing countries have obtained electricity from rooftop-mounted solar systems over the past decade.

Cleaning domestic solar heating panels in Australia.

they were testing produced electricity when exposed to sunlight. When the work of the two groups was merged, a breakthrough was achieved: a silicon cell that converted 4 per cent of all incoming sunlight into electricity—five times as much as the best selenium cell. Within a few months, the Bell team had pushed the cell's efficiency to 6 per cent. Excitement about this development was compounded by the fact that silicon is the second most abundant element, constituting 28 per cent of the earth's crust. Soon, the Bell scientists began to speculate that silicon solar cells might become a major source of electricity, and their enthusiasm was echoed by the popular media, which touted the imminent arrival of a solar-powered future.

Spin-off from the space race

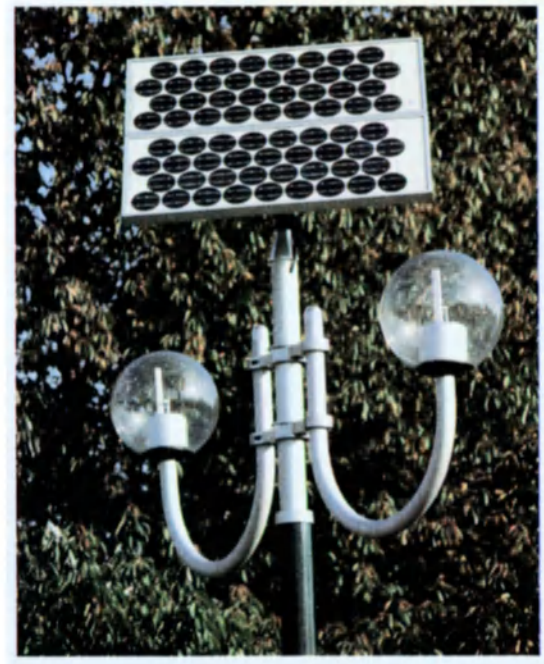
Realizing that potential turned out to be a far greater challenge than anticipated. The initial silicon solar cells cost roughly $600 per watt ($3,000 in 1993 dollars), several thousand times as much as electricity from conventional plants. After building a few prototype solar panels, Bell Labs decided that no commercial applications were within reach and shelved the new technology. The photovoltaic cell was saved from obscurity by the U.S.-Soviet space race in the 1960s. In the rush to find a practical way to power satellites, U.S. space scientists dusted off the solar cell.

During the next decade, a sizable infusion of U.S. government funds served to jumpstart the photovoltaic industry. Within ten years the price of solar cells was cut by a factor of five to ten, the cell efficiency rose and the durability of the devices improved. Producing these early PV cells required pure, expensive silicon and wasteful, energy-intensive manufacturing processes. Individual wafers of silicon were sliced from long crystals grown at temperatures above 1,400 degrees Celsius. Although costs were beginning to fall, PVs were still too expensive for any application other than the government-funded space programme.

The 1973 oil crisis created a new race—to bring photovoltaics back to earth. Government energy agencies and scores of private companies invested billions of dollars in advancing the state of photovoltaic technology. By 1980, the efficiency of commercial PV modules had risen to more than 10 per cent, and the price had fallen to roughly $12 a watt ($21 in 1993 terms). Finally, silicon PV cells were cheap enough to fill the niche Bell Labs originally tried to create for them. During the 1980s, solar cells were widely deployed at telephone relay stations, microwave transmitters, remote lighthouses and roadside callboxes—applications where small amounts of power are needed and where conventional power sources are either too expensive or not reliable enough.

The technology continued to advance during the next decade, and by 1993 the average wholesale price of photovoltaics had dropped to between $3.50 and $4.75 a watt, or roughly 25-40¢ a kilowatt-hour, thanks both to higher efficiencies and more automated manufacturing processes. As costs fell, sales rose—from 6.5 megawatts in 1980 to 29 megawatts in 1987, to 60 megawatts in 1993. The worldwide industry, including ancillary activities such as retail sales and installation, did roughly $1 billion worth of business in 1993.

Although still too expensive to compete head-to-head with conventional generating technologies, photovoltaic cells have found ever-larger niches in the global energy market. The



Some of the many uses of solar energy. Above, a solar reflector cooker (Kenya); above right, a Paris street lamp (France); right, a telephone booth in Australia.

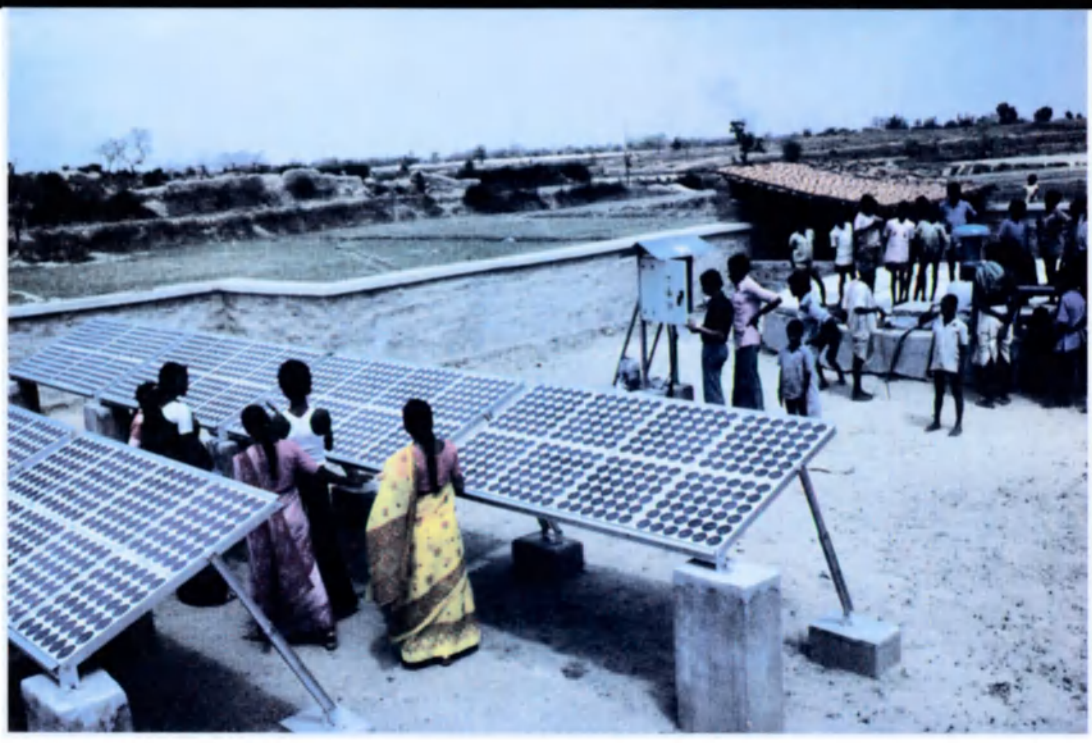
technology's versatility was best demonstrated in the mid-1980s, when Japanese electronics companies came up with a particularly ingenious application, attaching tiny solar cells to small consumer devices such as handheld pocket calculators and wrist-watches. These require only a trickle of electricity, well within the capability of a small solar cell—even when operating in a dimly lit room. Since the late 1980s, the Japanese have sold an average of about 100 million such devices each year, an application that absorbs 4 megawatts of solar cells annually, 6 per cent of the global market. The use of solar cells in consumer electronics has levelled off in recent years, as has that in telecommunications, surpassed by more rapidly growing applications ranging from rural water pumps to village homes and rural electricity.

By the early 1990s, thousands of villagers in Africa, Asia and Latin America were doing the same thing as Manolo Hidalgo, using photovoltaic cells to power lights, televisions and water pumps, needs that are otherwise met with kerosene lamps, rechargeable batteries and diesel engines. More than 200,000 homes in Mexico, Indonesia, South Africa, Sri Lanka and other developing countries have obtained electricity from rooftop-mounted solar systems in the past decade.

Prospects for using solar photovoltaics in ever-wider applications hinge on how rapidly the technology evolves. Prices will need to be cut by a factor of three to five in order for large-scale grid-connected applications to become economical. Most PV experts are confident that such reductions can be achieved by continuing the advances in cell efficiency and manufacturing processes of the past two decades and by capturing the cost-saving potential of mass production. ■

India's self-help solar villages

by Sanjit Bunker Roy



Solar panels supply power for a water pump (above right). This pump in the village of Sarwal in Bihar (India) has been powered by solar energy since 1982.

India is full of contrasts and contradictions. On the one hand there is "Bharat" or traditional India with its 600,000 villages, where life moves slowly, where centuries-old social structures remain unchanged, and where 70 per cent of the country's 940 million people live and die. And then there is "India", a young country struggling to overcome the usual problems of underdevelopment. "India", argues Bunker Roy, has often opted for large dams or electrification projects that sometimes fail to respond to the needs of the humbler inhabitants of "Bharat". Here he talks about two successful community-based projects which, with the use of solar energy, have transformed the lives of poor farmers in depressed regions of Bihar and Orissa and of people living in remote Himalyan villages.*

It takes twenty-nine-year-old Tsewang Narbo two days to walk across the 6,000-metre-high Khardungla pass, the highest in the Ladakh area of India's northern state of Jammu and Kashmir. A further 60 kilometres by bus and army truck bring him to the district headquarters in Leh. Here he picks up distilled water, fuses and other equipment before beginning the long trek back home to his wife and five children.

But Tsewang Narbo does not mind the hardship or the strain. Since 1993, this barely literate man has become one of the most important persons in the remote Himalayan village of Diger where he is responsible for the upkeep and maintenance of 59 solar photovoltaic units (SPVs) which provide lighting for his and surrounding villages and which have transformed life during the long-snow-bound winters when temperatures can reach -30°C.

Until 1989, the energy needs of these far-flung villages had been most inadequately met by Diesel Generating (DG) sets which are costly, centralized and unreliable, as well as using fossil fuel that pollutes the environment.

Since it takes twenty-five days to haul up as many litres of fuel to these villages located at a height of 5,000 metres, the inhabitants used it extremely sparingly to make it last the six months of winter. At night, entire families huddled around a single light no stronger than a candle flame. Solar lighting therefore seemed nothing short of a miracle.

When the idea of training semi-literate, unemployed rural youth to install, maintain and repair solar units was first put forward by an organization called the Social Work and Research Centre in Tilonia, Rajasthan, engineers and government officials felt it would never work. They were convinced the rural poor were too backward and illiterate to be given so much responsibility. There was also resistance from contractors and transporters who supplied DG sets, transmission wires, poles and diesel, and who stood to lose their business.

But the response from the villagers was so enthusiastic that it ground out all opposition. They were even willing to pay one dollar per unit per month for solar lighting; paying for such

At night, entire families huddled around a single light no stronger than a candle flame. Solar lighting therefore seemed nothing short of a miracle.

In Tilonia, a village in India's Rajasthan state, "barefoot engineers" operate solar installations and teach young people about solar energy.

services, however heavily subsidized, is unheard-of in Ladakh. So far, nearly $3,000 have been collected from the 28-village community.

Tsewang Narbo, who was selected for the job by the village community in June 1993, is now capable of fabricating invertors—devices that convert direct current into alternating current—and other apparatus, repairing fuses, changing tube lights, filling batteries with distilled water, and installing solar units in villages which can only be reached on foot. (When the SPVs were installed in 1993, the batteries and panels were brought up by yaks and then airlifted by helicopters of the Indian Air Force.) His job has so far brought him a total of $260, a welcome addition to his meagre earnings from goat farming.

Tilonia's efforts have also brought about a change in the energy policy of the State Government of Jammu and Kashmir. There are now about a dozen trained persons like Tsewang Narbo who look after solar units installed in 500 individual houses in over twenty villages.

Solar pumps bring life to dying villages

The large-scale use of solar energy in India was first promoted by Pierre Amado, often described as "a Frenchman with an Indian heart". Amado, who served as French Cultural Attaché in India between 1953 and 1960, was so fascinated by Indian culture that he specialized in the Ganges Valley civilization and now teaches post-graduate courses on the subject in Paris.

"As I became older," he explained, "I began to ask myself: 'I have taken so much from India, but what have I given back?' I thought the time had come to pay my debts to India. Since I knew the villages in the Ganges valley particularly well, I decided to launch a project there. I talked to several researchers and came to the conclusion that the use of solar energy for pumping irrigation water would be most appropriate."

India has over 90 million farmers with small land holdings. Most of them remain without water during the summer months. There is water but no power to pump it and so many farmers are being forced to migrate to the cities. "I realized that unless something was done to help these very tiny hamlets inhabited by very poor people they would be condemned to underdevelopment for centuries to come. The villages I am talking about are not connected to roads and have not been electrified," says Amado.

In 1979, Pierre Amado launched an association called ASVIN (Application of Solar Voltaics in Villages in India and Nepal), which in Indian mythology signifies the twin sons of the sun, symbolizing agriculture and animal husbandry. Working with local voluntary organizations in the villages of Sarwar (Bihar) and Gobalpur (Orissa), ASVIN has been able to demonstrate that if the community is taken into confidence during the planning process, and if local skills are mobilized, barely literate villagers are capable of installing, maintaining and repairing solar pumps for irrigation on their own.

"I remember the ceremony to inaugurate the solar pumps in the village of Sarwar in Bihar in 1982," says Amado. "The Development Commissioner gave wheat and vegetable seeds to each family. Since in this region wheat has not traditionally been cultivated, I thought the villagers would either sell the seed or grind it for flour. But not one of them sold the seed. They told me 'We want to eat the wheat grown with our solar water.' I call it harvesting the sun." ■

SANJIT (BUNKER) ROY
is director of the Social Work and Research Centre at Tilonia, Rajasthan state, in northern India. He is also chairman of the Environmental Liaison Centre International (ELCI), a non-governmental organization based in Nairobi.

* Bharat is the traditional Sanskrit name for India. *Editor*

The World Solar Summit

interview with Boris Berkovsky

A solar highway to sustainable development

■ **July 1993 marked the start of UNESCO's "World Solar Summit Process". What is involved in this?**

— The "World Solar Summit Process" is a campaign launched as a result of a successful meeting on the theme of "The sun in the service of mankind" that was held at UNESCO Headquarters in July 1993. Experts from all over the world attended the meeting in a personal capacity and contributed to highly specialized discussions on renewable energy sources, including solar energy. Over sixty assessment reports were prepared, covering all aspects of research, development, production, marketing and public attitudes. As a result of these reports, we launched a campaign with specific projects, targets and evaluation systems.

■ **What are the goals of the campaign?**

— They are clear and detailed. The major aims are to enhance understanding of the role that renewable energy sources can play in safeguarding the environment; create a global information network using state-of-the-art communications technology; promote and harmonize co-operation in training and research; demonstrate that the use of solar energy is a cost-effective and rapid way for many developing countries to reduce energy costs in remote rural areas; and to identify and define strategic projects of exceptional quality and global importance.

■ **In practical terms, what is the field of application of solar energy?**

— It could be far broader than it is today. Solar energy is not a miracle solution, but it has not been widely used until now because of lack of investment. Solar energy should be given the place it deserves in the mix of energy sources. It is available, flexible and ecologically viable. Considerable progress in exploiting solar energy has been made, and today it is realistic, not utopian, to be optimistic about its prospects.

■ **Where has the most progress been made in the past few years?**

— Notable progress has been made in research and technology. Solar energy has a leading part to play in all fields where only small amounts of power are required, especially in remote rural areas not covered by the grid. In this context,

solar energy is being widely used to generate electricity for telephone systems, and in developing countries it is also providing much of the power for refrigerating vaccines. Solar cookers have been developed, and after proving their worth in India, they are now being used in Nigeria and are being produced locally in other parts of the world. Solar pumps are increasingly being used in Mali.

■ **Has North-South co-operation encouraged the development of new technologies?**

— The countries of northern and southern Africa are making growing use of renewable energy sources, and this means that there must be a gradual transfer of technology to ensure that the aid they receive is effective. In the field of photovoltaic electricity, where the number of uses is still growing, specialists must be trained so that solar energy can be rationally used for pumping water, providing community lighting in remote villages, refrigeration in dispensaries, for telecommunications and various other applications.

■ **A World Solar Charter is currently being prepared. What is going into it?**

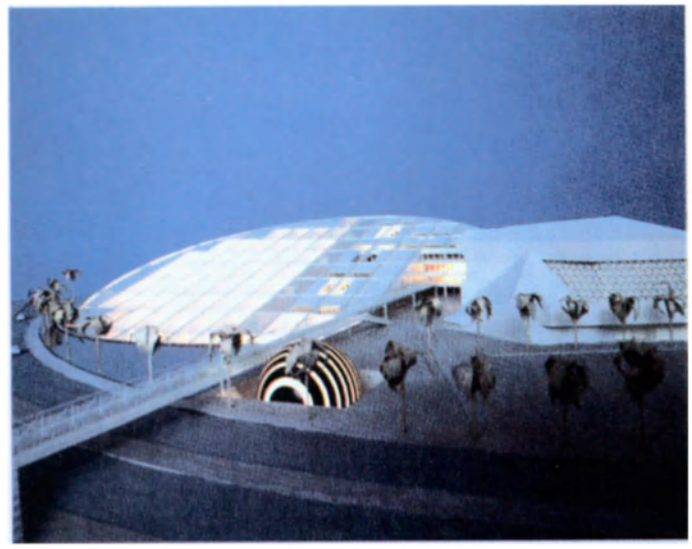
— This document is intended to define universal principles, rules and procedures of the World Solar Programme. It will stress a number of priorities such as the creation of national infrastructures to act as focal points; the matching of social and economic development aspirations in rural areas; development of global networking systems; and the adoption of new education and training programmes at all levels.

■ **What will be the next important meeting of the World Solar Summit process?**

— The World Solar Programme, which will be carried out between 1996 and 2005, should be approved by a World Solar Summit scheduled to be held in March, 1996 in Harare, on the invitation of Mr Robert Mugabe, the President of Zimbabwe. The Summit will put us on a solar highway towards sustainable development. ■

Interview by Juliette Boussand

BORIS BERKOVSKY
is head of Unesco's Engineering and Technology division, and president of the organizing committee of the World Solar Summit.



The new library of Alexandria

'ALEXANDRINA NOVA': A STAR IS BORN

In 1988 the Egyptian government, in co-operation with Unesco, began work on the new library of Alexandria, which will open at the beginning of the next century. It is designed to meet a threefold purpose: to foster a spirit of openness, to explore many fields of knowledge and to render knowledge accessible through state-of-the-art technology.

Alexandria was predestined to play this role. In Antiquity it was the site of the first universal library in the history of humanity. As a crossroads in today's world between the West and the Middle East, Alexandria will use its new library to become a beacon once again for the Mediterranean world.

An instrument of knowledge and education like its illustrious ancestor, the new "Bibliotheca Alexandrina" will be fully computerized. Its catalogue will gradually become available for consultation in the region's universities and information centres. Through a regional server, researchers throughout the world will be able to access a data bank containing the library's important collections. In addition to specialized collections on Mediterranean civilizations, the library will contain major collections on science and technology, environmental issues and economic development. It will also house an international school for the information sciences.

Strikingly beautiful in its architecture and entirely functional, the library is being built on the shores of the Mediterranean in the form of an up-ended cylinder, 160 metres in diameter. Its "roof" slopes at an angle to counteract the harmful effects of sea spray and allow the upper floors of the library to enjoy natural light.

The architects have not strictly speaking designed the library as a solar symbol, but they agree that it is intended as an image of radiance and openness. From above, its circular form resembles the sun as generally depicted in ancient Egyptian hieroglyphs. This association with the solar disk is accentuated by a desire to renew contact with the universal knowledge and wisdom of the ancient library and to contribute, through this ultra-modern centre of cultural and scientific exchange between East and West, to understanding between peoples and to the construction of peace. ■

The sun is a star

The sun is a globe of gas that derives its energy from thermonuclear reactions (the conversion of hydrogen into helium).

The sun is a star like any other. It appears brighter because it is nearer.

The elements of which the sun is composed are the same as those found on earth and throughout the universe.

THE SUN'S PHYSICAL CHARACTERISTICS

Diameter: 1,400,000 km
109 times that of the earth

Mass: 2 x 10^{30} kg
333,000 times that of the earth

Age: 4.5 thousand million years
total life span: 10 thousand million years

Density (compared to water):
average: 1.4
at the core: 160
in the photosphere: 10^{-9}

Energy output:
total: 4 x 10^{23} kW
received on earth:
if there were no atmosphere: 1,400 W/m^2
after passing through the atmosphere:
240 W/m^2

Temperature:
at core: 15 million° K
visible surface
(photosphere): 5,800° K
corona: 1.5 million° K

Magnetic field:
In the photosphere between 1 gauss (twice the earth's magnetic field) and 3,000 gauss.

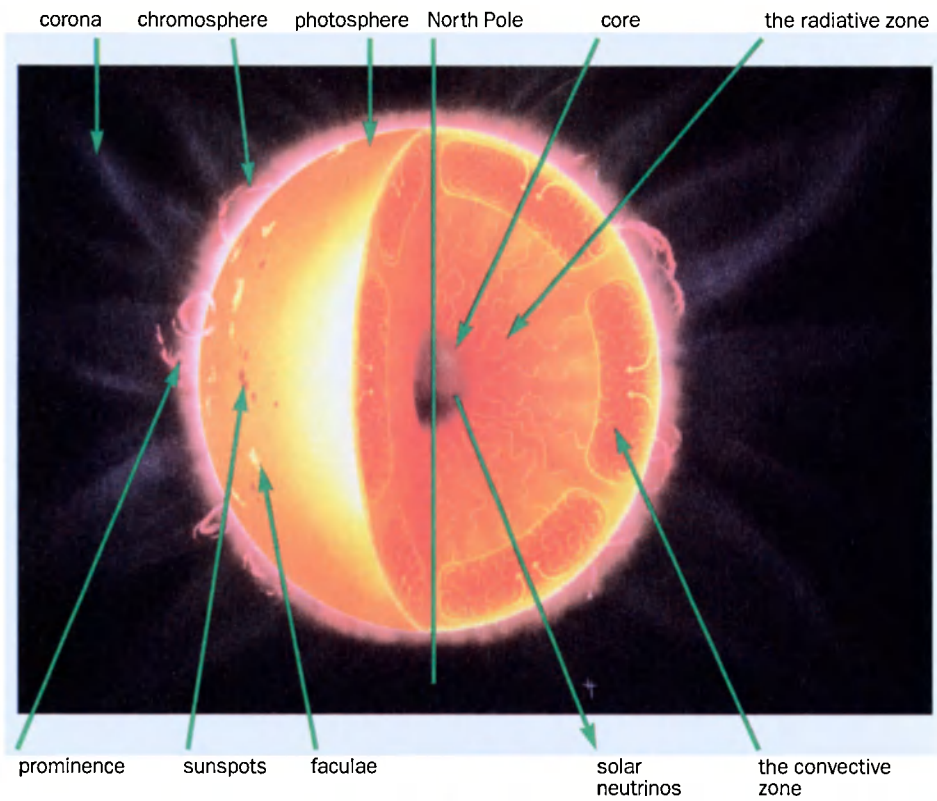
Distance from sun to earth:
149,600,000 kilometres
varying between 147 million km in winter and 152 million km in summer (for the northern hemisphere)

Main elements
except in the thermonuclear core:
(percentage in mass)
Hydrogen: 73.5%
Helium: 24.8%

Other elements: 1.7%
including
Oxygen: 46%
Carbon: 17%
Iron: 9%
Neon: 7%
Others: 21%

Source: Palais de la Découverte, Paris

THE SUN'S STRUCTURE



Source: *Le Soleil*, P. Lantos, PUF publishers, Paris ("Que sais-je?" series)

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COMMENTARY

Building a culture

I see two global threats which are jeopardizing the future of the world and call for the utmost vigilance from UNESCO.

The first is the split between North and South, which is growing wider and can only be gradually reduced by establishing a genuine world partnership for development. If this development is to be genuine, it must be *human*, in other words it must be endogenous, sustainable, equitable and conscious of its cultural dimension. Promoting this kind of development on a worldwide scale will call for a new sense of solidarity in the international community and developing much greater synergy between the organizations and mechanisms involved internationally.

We should invest less in peace-keeping, for which countries are traditionally well equipped, and more in peace-building, which is a much more difficult exercise, as so many recent events have shown. The most crucial problem of our time is that of population growth, which it will only be possible to control through education and the development of human resources. By investing in education, especially in education for young women, it should be possible within the space of fifteen years to scale down the rate of population increase, which is currently running at one million persons every four days. Furthermore, the only way to stem the flow of emigration, which may in a few years' time result in violent social upheavals, is to encourage endogenous development: helping countries to

of peace

release their own potential and to encourage the transfer of knowledge so as to alleviate the poverty and distress that compel people to leave their own countries.

The type of human development which UNESCO is advocating and is resolutely encouraging in all the fields of its competence is not confined to the economically least privileged countries. The concepts and principles involved apply as much to the rich countries as to the poor: as long as the privileged 20 per cent of the world's population, who enjoy 80 per cent of the resources it has to offer, are not prepared to share them and reduce current inequalities and imbalances, all strategies for the future will remain empty rhetoric. Human development is not meant for some as opposed to others, but for everyone. The "haves" must realize that sharing means giving something up, and the beneficiaries of aid must realize that only development based on their own talent and natural wealth will enable them to control their own destiny, without relinquishing their culture, identity and history.

The second threat is one that compromises the peaceful coexistence of different cultures and ethnic groups. Such coexistence is both a duty and a right.

Here UNESCO has set itself the priority of promoting a "culture of peace". Accordingly it must step up its efforts to encourage the development of a worldwide culture of non-violence, peace and equity, especially through respect and mutual tolerance and the consolidation of pluralistic and open societies that can flourish in a climate of democracy and respect for human rights.

We start from the central idea that the use of force to keep the peace is symptomatic of conventional attitudes and procedures. Force is costly in terms of economics and human suffering, but it is a price we have become accustomed to paying. It must be admitted that the good sense needed to forestall conflict, to make coexistence and reconciliation possible, in short to build the defences of peace, does not yet form part of our "defensive capability". In the case of most nations, the vision of the founding fathers of UNESCO, who had just lived through the horrors of war and genocide, has not been interpreted as it should have been, by adopting appropriate domestic and international instruments. As a result, the prevention of war does not feature in our budgets or our political programmes and some, with a short-sightedness that it is difficult to understand, wonder what benefits can accrue to them by helping UNESCO to grow and prosper.

The future will depend on those who are capable of attaching a value to intangible things, who realize that not everything can be measured in terms of foreign exchange or can be bought and sold. As the Spanish poet Antonio Machado warned us, "only fools confuse value and price". The only way for us to change course is by attaching value to good sense, not by paying the price of force. ■

The Pantheon, Rome's other symbol

by Cécile Duvelle and Mauro Rosi

The Pantheon is one of Rome's oldest, best-preserved and most popular monuments. It is located in the heart of the old city, which was included on UNESCO's World Heritage List in 1980.

PEOPLE are sitting round the fountain. Some are reading, some are chatting, and even though it is midwinter some are eating a *granita di caffé con panna* (iced coffee topped with whipped cream), the speciality of a nearby coffee shop. Here in the Piazza della Rotonda, a square in the heart of Rome's historic centre frequented twenty-four hours a day by strolling tourists, Romans and the ubiquitous pigeons, people often sit and relax at the foot of this great baroque fountain from which water gushes endlessly and which is topped by an authentic Egyptian obelisk from a far-off temple to Isis.

Across the way, ignored as only a familiar feature of the landscape can be, stands a monumental circular domed building—the Pantheon—which gives onto the square via a marble and granite portico more than thirty metres wide. The passersby seem unaffected by its mysterious presence and the ancient and sacred aura it exudes despite its excellent state of preservation. One might even think that all this puts them at their ease.

The Pantheon has stood there since it was built in 27 B.C., during the turbulent period between the fall of the Roman Republic and the rise of the Empire, when Julius Caesar's adopted son, Octavius, was pitted against Antony and Cleopatra, among others. Some tourist guides refer to it, after the Coliseum, as "the other symbol of Rome". It was in the heart of Rome that the Pantheon was built, was transformed and survived many centuries of change. Perhaps because it provides a thread of continuity it seems such a natural part of the great city today.

A familiar temple

At first, as its Greek name indicates, the Pantheon was "the temple of all the gods". Its appearance changed over the centuries to accompany the metamorphoses of Rome itself—as capital of the early and then the later Empire, of the Western Roman Empire, as Papal Rome, as the baroque Rome of the Counter Reformation, as the city of the Vatican and, since 1870, as the capital of Italy. Each of these stages in Rome's history was marked by momentous events.

Opposite page, aerial view of part of the old city of Rome. Near centre of photo is the dome of the church of Sant'Agnese in Agone on the Piazza Navona. Higher up is the dome of the Pantheon, pierced with a round opening or oculus.

Left, the Pantheon's imposing façade on the Piazza della Rotonda. The portico bears the inscription: M. AGRIPPA L.F. COS. TERTIUM. FECIT (Marcus Agrippa, son of Lucius, consul for the third time, built this).

UNESCO IN ACTION
HERITAGE

Originally the Pantheon resembled a Greek temple with a central altar and a *pronaos* (or portico). A rectangular building, it was rebuilt in its present circular form by the Emperor Hadrian. The most radical functional change was introduced in 609 as a result of a decision by Pope Boniface IV, who restored it, dedicated it to Christian worship and named it Santa Maria dei Martiri (St Mary of the Martyrs).

The history of the Pantheon has not been uneventful. Pope Urban VII ordered it to be stripped of its bronze statues so that they could be melted down and used in the canopy of St Peter's basilica. Later, the great Counter-Reformation architect Bernini added what the Romans soon began to call "donkey's ears", i.e. two small pinnacles, one at each end of the pediment.

In 1980 the Pantheon and the historical centre of Rome were added to UNESCO's World Heritage List. The listing was justified in the following terms, "Ever since its foundation, which legend sets in 753 B.C., Rome has always been associated with the history of humanity. The capital of an empire that dominated the Mediterranean world for five centuries, it later became the capital of the Christian world and still today performs these essential religious and political functions." The Pantheon, which wears its 2,000 years so lightly, is a living historical reality.

Naturally most people are primarily interested in the Pantheon as a monument and as a museum. It is the eternal resting-place of the immortals and of a number of artists and kings, including the first king of united Italy, Victor Emmanuel II, his son King Humbert I, and Humbert's queen, Margherita of Savoy. A few years ago, the prospect of transferring to the Pantheon the mortal remains of Italy's last king sparked off controversy in some sections of Italian public opinion which has still not died down. Also in the Pantheon is the tomb of Raphael, who was long considered as the greatest of all painters and whose genius conferred so much beauty on Rome. Other major artists interred there are Giovanni da Udine, Perin del Vaga, Annibali Carrachi, Taddeo Zuccari and Baldassare Peruzzi.

A living monument

The Pantheon is also a favourite meeting place for Romans and for visitors to Rome. With its apocalyptic traffic jams Rome is a city where punctuality is always threatened; the slightest incident can make you half an hour late for an appointment. People often arrange to meet in a familiar place where they can sit and wait. The portico of the Pantheon with its sixteen towering granite columns and its pediment of white marble provides perfect shelter on a torrid summer day or during the *acquazzoni*, the diluvian summer—and winter—rain that is so different from London drizzle and the only slightly heavier rain of Paris. People meet there before going to the cinema, window shopping or talking business. Impeccably groomed young people, wearing sun glasses from March to October, gather at the foot of the walls on each side of the Pantheon. As they sit and wait, they read the papers, chat and eat ice-cream.

The Pantheon is at the heart of a lively neighbourhood that does not only live on its past but is also a centre of commerce, culture and politics. In this sense Rome's historical centre is fortunately different from that of many other cities which, in Italy and elsewhere, have been destroyed as living communities and sacrificed on the altar of their own beauty. So many places where people live become lifeless museums dedicated to the past! One day perhaps we shall decide to protect examples of urban beauty from becoming museum pieces and prevent the impoverishment of life in traditional urban communities.

Luckily, Rome's historic centre is not a tourist showcase. Economic life goes on there independently of the museums and the visitors. With its pizza stands, its organic and macrobiotic food shops, its Zen meditation centre and handicraft shops, bookshops and jewellers, the Pantheon district bustles with life. On the Via della Maddalena, there are a number of excellent and renowned ice-cream shops, ranging from the innovator who some years ago launched a sensational liquorice ice-cream, to Giolitti, a temple of traditionalism, with its small, round, French-style tables, elegant and nimble waiters, and flavours and utensils that have not changed for a century. Nearby is the Parliament building. The street, paved with *sampietrini*, "small sacred stones" or "small St Peters", is closed to cars but is used by noisy and acrobatically ridden mopeds, and horse-drawn carriages filled with tourists.

In summer the light beige of the Pantheon stonework, mingled with the red and ochre of the surrounding buildings, creates an "African" effect that is accentuated by the greenery that protrudes from between the stones.

A sublime presence

The Pantheon is a monument, a meeting place and a refuge, but it is also something more. It does not stand in splendid isolation; its mystery gives light and meaning to everything around it. Not only on the Piazza della Rotonda, but far beyond in the narrow, cobbled streets, everything—from stray cats to fashion shops—is somehow illumi-

The Pantheon in figures

DATES

27 B.C.: The Pantheon founded by Agrippa as a temple to the glory of the Olympian gods

80 A.D.: First extensive restoration, by Domitian.

125: Restored by Hadrian. The Pantheon acquires its extraordinary coffered dome with an opening (oculus) at the apex.

609: The Pantheon becomes a Christian church dedicated to St Mary of the Martyrs (because of the martyrs' remains transferred to it from the catacombs).

1563: Restoration of the great bronze door.

DIMENSIONS

Portico: 33 metres wide and 15.45 metres deep.

Columns: 12.5 metres high.

Walls: 6.7 metres thick

Dome: 43.3 metres high with the same diameter

Oculus: 9 metres in diameter.

MATERIALS

Granite, marble, brick and bronze.

nated by its poetic grandeur. As Heidegger writes in his *Holzwege* of a Greek temple, such a building "attributes their essential characteristics to things and the idea they have of themselves to people". Around the Pantheon the mundane and the sublime intermingle.

But even if the Pantheon did not exist, Rome's historic centre would still be one of the world's most beautiful places. All around are exceptional sites, buildings and monuments, where imperial Rome, Renaissance Rome, and the Rome of the popes and the Risorgimento meet and overlap. To move away from the Pantheon is not to elude its mystery. Here beauty is almost commonplace, an unobtrusive, silent, discreet companion. In Rome the past is not a memory. The fountains still exist, as they did four centuries ago, to provide drinking water for passersby, to refresh and bring delight. As in the seventeenth century the churches are open to the community and the public at large. They are Christian temples where mass is celebrated at least twice a day, centres for social action and for receiving alms. Hands in pockets, on bicycles or mopeds, people go about their business through the entrancing city, occasionally stopping to sit down on marble benches that date from the baroque period and wear their 400 years with panache.

Two minutes away from the Pantheon is the Piazza Navona, unchanged since the Counter Reformation. Even closer is the beautiful church of San Luigi de Francesi with its Caravaggio paintings. In the opposite direction is the Piazza della Minerva, where Stendhal once lived. An Egyptian obelisk crowned by a small elephant, ironically called "the chick" by the Romans, stands in front of the church of Santa Maria sopra Minerva, a gothic building housing the tomb of St Catherine of Siena, and a miniature museum of painting. Also no more than a few minutes' walk from the Pantheon are the Palazzo Madama, seat of the Italian Senate, the Mausoleum of Augustus, the Piazza di Spagna and the Piazza Sant'Ignazio. Perhaps this explains why there are so many well-stocked shoe shops in the Eternal City. ■

CÉCILE DUVELLE AND MAURO ROSI
are staff members of the UNESCO Publishing Office.

Opposite page, inside the Pantheon. Its dome is one of the world's largest. Light pours in through the unglazed oculus onto the coffered interior of the dome and the walls beneath. Large recesses adorned with columns once contained statues of the gods.

Below, Via del Corso, one of Rome's busiest streets. The 1.5-km-long street owes its name to the horse races that were once held there.

People meet at the Pantheon before going to the cinema, window shopping or talking business. Impeccably groomed young people gather beneath its walls, reading newspapers, chatting, eating ice-cream.

MAMBO MANIA

by Isabelle Leymarie

Of African and European parentage, the mambo is the result of a long cross-cultural journey, an example of the kind of sensual alchemy which is a speciality of the Caribbean. *Mambo*, *conga* and *bongo* were originally Bantu names for musical instruments that were used in rituals and gradually became secular. *Mambo* means "conversation with the gods" and in Cuba designates a sacred song of the Congos, Cubans of Bantu origin. The Congos have absorbed a variety of foreign influences and the mambo is a delicious cocktail of Bantu, Spanish and Yoruba.

Despite its African resonance, the mambo can be traced back to an unexpected source, English country dance, which in the seventeenth century became the contredanse at the French court and later the *contradanza* in Spain. In the eighteenth century the *contradanza* reached Cuba where it was known as *danza* and became the national dance. Its hold grew with the arrival of the planters and their slaves who fled from Haiti after it became independent. The Haitian blacks added a particularly spicy syncopation to it called the *cinquillo*, which is also found in the tango, itself derived from the *contradanza*. Gradually other black elements found their way into the *contradanza*, some titles of which—such as "Tu madre es conga" ("Your mother is Congo"), which was played in 1856 in Santiago de Cuba at an aristocratic ball in honour of General Concha, and "La negrita"—reflect this blending.

A NEW KIND OF MUSIC

At the end of the nineteenth century the *contradanza* threw off its European yoke, and freer, more spontaneous dancing by couples replaced the starchy formality of the contredanse. This new kind of music was known as *danzón*. In 1877 it had a huge success largely due to pieces such as "Las alturas de Simpson" by a young musician from Matanzas, Miguel Failde. The *danzón* had several sections, one of which was a lively coda which musicians soon got in the habit of improvising. It was played by brass bands or *tipicas*, which gave way in the 1920s to lighter combos known as *charangas*, which featured violins, sometimes a cello, a piano, a *güiro* (a grooved calabash scraped with a comb), a clarinet, a flute, a bass and double drums adapted from European military drums.

'MAMBO, que rico el mambo!'

In the post-war years the mambo was a euphoric and voluptuous celebration of the long-awaited return of freedom. Many will remember the great Italian actress Silvana Mangano dancing the mambo in the marvellous film of the same name.

Charangas, notably that of the flautist Antonio Arcaño, flourished in the late 1930s. In 1938 Arcaño's cellist, Orestes López, composed a *danzón* he called "Mambo", and in the coda Arcaño introduced elements from the *son*, a lively musical genre from Cuba's Oriente province. As a signal to band members that they could start their solos, Arcaño would call out, "Mil veces mambo!" (A thousand times mambo!). Today, in the Latin American music known as *salsa*, the mambo is a theme that is played in unison by the rhythm section and serves as a transition between two improvised passages.

Arcaño was a talented musician, but it was his countryman Pérez Prado who was the first to market his compositions under the name "mambo", which he popularized as a specific musical genre. He used jazzier instruments, including brass and drums. Early in the 1950s his mambos "Patricia" and "Mambo N° 5" took Latin America and the United States by storm.

THE TEMPLE OF MAMBO

By the mid-1950s mambo mania had reached fever pitch. In New York the mambo was played in a high-strung, sophisticated way that had the Palladium Ballroom, the famous Broadway dance-hall, jumping. The Ballroom soon proclaimed itself the "temple of mambo", for the city's best dancers—the Mambo Aces, "Killer Joe" Piro, Paulito and Lilón, Louie Máquina and Cuban Pete—gave mambo demonstrations there and made a reputation for their expressive use of arms, legs, head and hands. There was fierce rivalry between bands. The bands of Machito, Tito Puente, Tito Rodriguez and José Curbelo delighted habitués such as Duke Ellington, Bob Hope, Marlon Brando, Lena Horne and Dizzy Gillespie, not to mention Afro-Americans, Puerto Ricans, Cubans, Upper East-Side WASPs and Jews and Italians from Brooklyn. Class and colour melted away in the incandescent rhythm of the music. Even jazz musicians such as Erroll Garner, Charlie Parker, Sonny Rollins and Sonny Stitt fell under the mambo's charm, as can be heard on the many latin recordings they made in the 1950s.

In 1954 the cha-cha-cha, a kind of mambo created by the Cuban violinist Enrique Jorrín, a member of the Orquesta América *charanga*, swept through Havana and New York. Easier to dance than the mambo, with a squarish beat and a characteristic hiccup on the third beat, it spread to Europe, before being dethroned in the early 1960s by the pachanga and then the boogaloo.

Since the mambo there has never been a dance that has given rise to so much unbridled fantasy and pyrotechnics or reached such rhythmic rapture. Today it is making a comeback and bringing a glimmer of paradise regained as the world again moves to its magical beat. ■

ISABELLE LEYMARIE
is a Franco-American musicologist.

GREENWATCH

SOLVING THE FOOD/POPULATION EQUATION

BY LESTER BROWN

SELDOM has the world faced an unfolding emergency whose dimensions are as clear as the growing imbalance between food and people. For our generation, the challenge is to reverse the deteriorating food situation and achieve a balance between people and food that is both humane and sustainable. And this, in turn, depends on reversing the deteriorating relationship between ourselves (currently increasing by 90 million per year) and the natural systems and resources on which we depend.

It cannot be argued that resources are not available. Despite the end of the cold war, the world is still spending close to $700 billion a year for military purposes, much of it designed to deal with threats that have long since disappeared. Meanwhile, the United Nations Population Fund (UNFPA), the lead agency in the effort to stabilize world population, has an annual budget of $240 million.

To stop soil erosion, tree seedlings are planted behind a protective windbreak of piled stones (Burkina Faso).

STABILIZING WORLD POPULATION

Elements of a global food and population strategy are, however, beginning to emerge. In April 1994, UNFPA sketched the outlines of a bold effort to stabilize world population at 7.8 billion by the year 2050. This plan is a broad-based one that includes family planning, raising the level of female education and pressing for equal rights for women in all societies.

Implementing the proposed UNFPA Programme of Action requires an estimated $11.4 billion for 1996, gradually rising to $14.4 billion by 2005. Of this total, roughly two-thirds is to be mobilized within developing countries themselves. The complementary resource flows from donor countries would increase to $4.4 billion (1993 dollars) in 2000, rising further to $4.8 billion in 2005.

Achieving the UNFPA's fertility reduction goals requires substantial increases in female education. Although the education of girls and women contributes simultaneously to economic progress and lower fertility, in many countries, fewer than half the girls of primary-school age are in class. Almost all governments have adopted universal primary education as a goal, but many have seen their educational system overwhelmed by the sheer number of children entering school. The governments of high-fertility societies cannot realistically hope to rein in population growth without broadening access to education and thus providing women with options beyond childbearing.

Fulfilling this social condition for a more rapid fertility decline will require a heavy investment in both school building and teacher training. Providing elementary education for the estimated 130 million school-age children not now in school (70 per cent of whom are female) would cost roughly $6.5 billion per year. Providing literacy training for those men and women who are illiterate and beyond school age would require an additional estimated $4 billion per year.

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THE SPACE SHUTTLE'S EYE IN THE SKY

In April 1994 a space radar laboratory developed by the United States, Germany and Italy was sent up on the U.S. space shuttle *Endeavour* to study the earth's environment. It sent back images of more than 69 million square km of the planet's surface, including such environmentally-delicate areas as rain forests in Bolivia and Brazil, and the Sahara Desert. The radar can penetrate beneath the tree-tops, making it possible to map variations in vegetation, wetlands and flooding under the forest canopy. The system should also make it possible to detect patches of crude oil dumped at sea by ships and even to discover new archaeological sites. ■

THE DESERTIFICATION CONVENTION

An International Convention to Combat Desertification was signed at UNESCO Headquarters in Paris on 14 and 15 October 1994. The United Nations Environment Programme (UNEP) estimates that the lives of 900,000 million people in over 100 countries are threatened because their land could be transformed into desert. More than a quarter of the earth's surface is concerned. According to UNEP, 69% of the world's 5.2 billion hectares of cultivated dry land have deteriorated and are in the process of becoming desert. The figures are 73% for Africa and 70% for Asia. In the arid zones, i.e. 35% of the earth's surface, 500,000 hectares of irrigated land become desert each year because of mineral salts in the water which leave deposits after evaporation. The poor countries are anxious. In 1980 an action programme promised them $2.4 billion, but they only received $600 million. UNEP currently estimates that between $10 billion and $22.4 billion will be needed annually for the next 20 years to restore fertility to the drylands. The Convention will come into force when it has been ratified by 50 states. For further information contact *EarthAction* (a network of 1,000 citizen organizations in 126 countries) 9 White Lion Street, London N1 9PD, United Kingdom. Tel.: (44 71) 865 90 09; Fax: (44 71) 278 03 45. ■

THE BEST COFFEE IS PREDIGESTED!

CERES, the journal of the United Nations Food and Agriculture Organization (FAO) has revealed a disturbing piece of news. The best coffee grains are not picked from the bush but picked up from the ground in the droppings of the luwak (*Viverra musanga*), a small cousin of the civet cat that lives on the coffee plantations of Indonesia, the world's third largest coffee-producing nation. Luwaks choose the ripest, most perfectly formed berries and eat the sweet husk. But they cannot digest the beans, which pass through their alimentary canals almost intact, undergoing

MASSIVE REFORESTATION

On the food side of the equation, major efforts must be made to protect the soil- and water-resource base and increase investment in agricultural research. At the root of food scarcity in many developing countries is the loss of vegetation from deforestation, overgrazing and overploughing. As vegetation is destroyed, rainfall runoff increases, reducing aquifer recharge, increasing soil erosion and, in turn, lowering the inherent productivity of the ecosystem.

Where firewood is scarce, crop residues are burned for cooking fuel, thus depriving the soil of needed organic matter. Adding trees to the global forest stock is a valuable investment in our economic future, whether the goal is to satisfy the growing firewood needs in the Third World or to stabilize soil and water regimes. Accordingly, we propose as part of a global food security budget a massive reforestation plan—totalling $5.6 billion a year by the end of the decade.

More than a billion people live in countries that are already experiencing firewood shortages. Unless corrective action is taken, that number will nearly double by the year 2000. An estimated 55 million hectares of tree planting will have to be done to meet the fuelwood demand expected then. In addition, anchoring soils and restoring hydrological stability in thousands of Third World watersheds will require tree planting on some 100 million hectares.

SOIL CONSERVATION

Planting trees to restore watersheds, thereby conserving soil and water, complements the expenditures on soil conservation by farmers. To calculate the cost of a global effort to stabilize soils, data are used from the United States, where it is estimated that roughly $3 billion a year would be necessary to stabilize soils on U.S. cropland.

First, it is assumed that one tenth of the world's cropland cannot sustain cultivation with any economically feasible soil-conserving agricultural practices—roughly the same proportion as in the United States. This would equal some 128 million hectares wordwide. Applying the cost of converting such land to grassland or woodland in the United States, at $125 per hectare as a first approximation, the global cost would be $16 billion per year. If expenditures to conserve topsoil on the remaining erosion-prone cropland—another 100 million hectares—are comparable to these, a global programme of conservation practices enacted by 2000 would cost an additional $8 billion annually.

By 2000, when both the cropland conversion programme and the full range of soil-conserving practices are in place, global expenditures to protect the cropland base would total some $24 billion per year. Although this is obviously a large sum, it is less than the U.S. government has paid farmers to support crop prices in some years. As a down-payment on future food supplies for a world expecting at least two billion more people, $24 billion is an investment humanity can ill afford not to make.

At a time when the backlog of yield-raising technologies is shrinking, international expenditures on agricultural research are diminishing. The urgency of reversing this trend is obvious. A remarkably successful international network of seventeen agricultural research institutes identifies gaps in global agricultural research and systematically fills them. Despite its widely recognized success, funding

A young Bangladeshi village woman (background) is taught family planning techniques.

LESTER BROWN,
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This article has been extracted from his book Full House, Reassessing the Earth's Population Carrying Capacity, *written with Hal Kane and published by Norton & Company, New York and London, 1994.*

A plantation of eucalyptus trees near Sucre (Bolivia).

of this network has dropped. At a time when every technological advance, however small, is needed to help buy time to slow population growth, investment in these centres should be rising, not falling.

FOOD SECURITY AND POLITICAL STABILITY

In summary, the food security budget we propose, including needed expenditures on both sides of the food/population equation, would start at $24 billion in 1996, increasing rapidly to just over $58 billion in the year 2000 and then grow much more slowly, reaching $61 billion by 2005. Athough the budget we propose is described as a food security budget, it is also a political stability budget—an investment in an environmentally sustainable, politically stable future.

Aside from the global food security budget, which involves public expenditures, there are several needs that are best satisfied by reforming economic policies, specifically those that deal with water efficiency and global warming. With water becoming increasingly scarce, future gains in irrigation depend heavily on the more efficient use of irrigation water. The key to this is to remove the subsidies that provide farmers with free water or water at a nominal cost. Only if farmers pay market costs for water will they make the needed investments in irrigation efficiency.

In a related area, much progress has been made in recent years in reducing fertilizer subsidies, a practice that often led to excessive fertilizer use and damaging levels of nutrient runoff into rivers and lakes.

The other area needing major reform is the tax system, which should be restructured so that those who burn fossil fuels pay the full costs of their use. As it now stands, a utility company that burns coal pays only for the costs associated with extracting and burning it, while others are left to bear the indirect costs of air pollution—health-care costs, crop losses and the damage from acid rain to forests and freshwater lakes. The motorist driving down the road never pays for the crop damage in the adjoining fields caused by pollution from the automobile.

Similarly, those who burn fossil fuels are not paying the costs of global warming and overall climate instability. Accordingly we recommend a restructuring of the tax system to partially replace income taxes with taxes on fossil fuels. This would help offset the inability of the market to fully incorporate costs, steering the evolution of the global energy economy in an environmentally sustainable direction. ■

A little girl at the blackboard in a rural school in the United Republic of Tanzania.

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a slight processing that actually improves their taste. Thirty years ago, the production of the precious beans was from 1,000 to 2,000 kg per day. By 1990, however, one company that specializes in luwak coffee was only able to buy about 20 tons a year, partly because plantation workers had taken to hunting luwaks for food. Which should come first, a good roast or a good cup of coffee? ■

FROM SWORD TO PLOUGHSHARE

In a swords-into-ploughshares operation following the end of the Cold War an American military reconnaissance plane has been converted into an environmental research aircraft. It will be used by the National Center for Atmospheric Research in Boulder, Colorado. The twin-engine jet can fly at any altitude from sea level to 20 km in the lower stratosphere and will study in particular the 12 to 18 km zone, a region not adequately covered by other research aircraft. The aircraft will mainly be studying atmospheric chemistry and climate questions. ■

AIR POLLUTION: THE PRICE OF PROGRESS?

Steelworks in the Chinese city of Benxi employ 140,000 people and turn out excellent products, but they also cause heavy air pollution. The city is located in a windless valley and releases 540 tons of pollutants into the atmosphere each year. Whereas the World Health Organization has set a recommended limit of particles in the air at 90 µg/m³, in Benxi the level reaches 740! Respiratory diseases and lung cancer affect a third of the population, a far higher figure than the national average. Air pollution, made even worse by growing automobile traffic, is the most frequent cause of death in China today. Is this the price of development? ■

LINGUA FRANCA

French-speaking environmentalists often complain that almost all reference works are in English. Now, as a result of an initiative by the French Minister of the Environment a remarkable new book has just appeared. Entitled *La planète Terre entre nos mains* ("Planet Earth in Our Hands"), it presents the implementation of the Agenda 21 programme set by the Earth Summit held in Rio de Janeiro in June 1992 and contains a mass of rarely compiled information and useful addresses, including a list of video cassettes and organizations that distribute them.

Contact *La Documentation française*, 29-31, Quai Voltaire, 75344 Paris Cedex 07. Tel.: (33 1) 40 15 70 00; Fax: (33 1) 40 15 72 30. ■

F. B.

ENDA TIERS MONDE, A FRUITFUL THIRD-WORLD DIALOGUE

BY FRANCE BEQUETTE

The international association ENDA Tiers Monde (Environmental Development Action in the Third World) is the hub of a network of reflexion, exchanges and field projects that extends to many parts of the Third World, from Senegal to Bolivia and from India to the Caribbean. Set up in 1972, notably with support from the United Nations Environment Programme (UNEP), it became in 1978 an international non-profit organization with headquarters in Dakar (Senegal). Through its efforts, researchers, engineers, economists, sociologists, educators and communications experts offer their services to volunteers, farmers, city-dwellers and technicians in developing countries, help them to win respect for their rights, identify their needs and achieve their goals. ENDA works at grassroots level and does all it can to involve local populations in the conception, implementation, management and control of development activities. It promotes local cultures and the use of local resources, and tries to resist imported consumption patterns and lifestyles. Its members are fieldworkers who are more familiar with village huts than air-conditioned offices and hotels.

Opposite, the terrifying figure of "Mr. Aids", created by Senegalese art-school students for ENDA.

IN THE FIELD

In 1990 the people of Dakar and its outskirts were inspired by the words of a current hit song to start cleaning up parts of their city and to cover walls with multicoloured frescoes. A movement known as *Set setal*, "be clean and make clean", was launched. ENDA joined forces with it—an ENDA team was already busy improving conditions in one of Dakar's slums.

Far away on another continent, in Bogota (Bolivia) ENDA has created the world's first recycling school, where children and adults learn about the uses of different kinds of wastes and are taught techniques for recycling them. The courses, which began in September 1994, last from six to twelve months and are fee-paying, although the size of the fee varies according to the pupil's means. In Rufisque (Senegal), where the local people were more than willing to pay a small sum to improve the salubrity of their neighbourhood, ENDA launched a garbage collection project using wheelbarrows four years ago. The compost produced from the garbage is sold to urban vegetable gardeners, enabling them to fertilize their gardens without using chemical products. Three similar projects are underway in Ho Chi Minh City (Viet Nam), Santo Domingo (Dominican Republic) and Bamako (Mali). Know-how and technology are imported from Bombay (India), Bogota (Colombia) and Porto Novo (Benin).

In the Caribbean ENDA is working with a UNESCO-Worldwide Fund for Nature programme on the study of medicinal plants. Four languages (English, Creole, French and Spanish) are used in the programme, which covers fourteen countries. Two competitions involving the identification and use of medicinal plants have been held in secondary school leavers' classes in Mauritius and Dakar.

In Zimbabwe, South Africa and Bolivia, an ENDA "youth action" team is training street educators to help city children and teenagers left to their own devices. This means getting on terms with the street children, helping them to survive by providing emergency aid but, above all, trying to find longer-term solutions to their problems.

In 1987 an ENDA health team joined the fight against Aids in Africa. It uses every available channel of communication—books, newspapers, comic strips, video, TV programmes, movies, plays, music and public events. A telephone help-line has been opened in Dakar. During major international conferences, ENDA publishes a daily newspaper to voice the concerns of the peoples of the South.

ENDA produces a wide range of written and audio-visual documents on environmental and development issues in English, French and Arabic. For further information contact ENDA Diffusion, 54, rue Carnot, BP 3370 Dakar, Senegal. Tel.: (221) 22 98 90; Fax: (221) 22 26 95. ■

FRANCE BEQUETTE is a Franco-American journalist specializing in environmental questions.

The UNESCO Prize for the Promotion of the Arts

In 1993, on the initiative of the Japanese painter Kaii Higashiyama, UNESCO created an international prize for contemporary art. Awarded biennially, and known as the UNESCO Prize for the Promotion of the Arts, it is intended to encourage young artists all over the world in such fields as painting, the graphic arts, drama, dance and music.

In 1993 the prize went to a number of artists working in new technologies (including video and photography), painting (including drawing and the graphic arts) and sculpture (including "installations", works that explore the relationship between people and their environment, and "Land Art", in which the artist works in and with nature).

Thirty-seven artists were pre-selected from almost 300 candidates Five winners were chosen, and four other candidates received honorary mentions. Charlotte Gyllenhammar (Sweden) and Osman (Turkey) shared the prize for sculpture. The prizewinners in the new technologies section were Susan Gamble (United Kingdom) and Michael Wenyon (United States). Felim Egan (Ireland) won the award for painting.

The works of the thirty-seven preselected candidates are featured in a catalogue that has recently been published by UNESCO's Division of the Arts and Cultural Life. While the selection does not pretend to provide a panorama of contemporary art worldwide, it does give what the president of the jury, Pontus Hulten, calls "a good general view of the situation and production of young artists in the world today".

The overriding impression is one of a quest that is both familiar and new. Familiar, because it continues the path marked out at the beginning of the century towards freedom and non-conformity in the act of creation. New, because it delves even deeper into the realm of invention.

Zodiac, a work by the prizewinners in the new technologies section, blends elements of traditional art-forms (sculpture, theatre and painting) in a new aesthetic, while creating on a symbolical level a synthesis between tradition and innovation. An easel, the time-honoured tool of the painter's trade, stands in the middle of a room that reminds us of a floodlit stage. It does not support a canvas but a shimmering horizontal bar which, although it seems tangible and "real", is actually pure illusion. It is a hologram, a three-dimensional image produced by interference between light from laser beams. This technique of using light to create art has been used for at least two decades without losing any of its fascination.

Water, as well as light, features among the works shown. *Pose*, by the French artist Emmanuel Saulnier, is made from pyrex glass, demineralized water and embossed aluminium. Just as extraordinary is a huge creation entitled *Kabelseele* (literally "cable soul"), into which Swiss artist Walter Siegfried has introduced the human voice. *Rigid Waves*, an original work by German artists Monika Fleischmann and Wolfgang Strauss, uses mirrors to put the spectator literally in the picture as he or she approaches it.

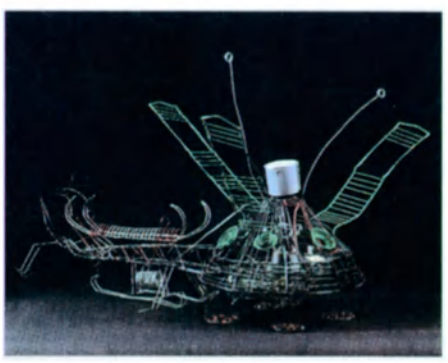
These creations of light, water, sound, voice and the human face are works that live, move and change with their audience. The challenge set by the new generation of artists is to capture the fleeting nature of experience and to abandon the docility of stone for less tractable media. Is the static work of art now a thing of the past? ■

Zodiac **(1989), 4.2 x 160 cm., a hologram on easel by Susan Gamble (United Kingdom) and Michael Wenyon (United States), prizewinners in the "new technologies" category of the UNESCO Prize for the Promotion of the Arts (1993).**

Candidates for the 1995 UNESCO Prize for the Promotion of the Arts should contact their country's National Commission for UNESCO.

The catalogue may be obtained from the Division of the Arts and Cultural Life, UNESCO, 7, Place de Fontenoy, 75732 Paris 07. Fax: (33-1) 4273-0401.

Hell Extinguisher **(1992), 59 x 100 x 85 cm., wire, sheet iron, assorted materials by Abu Bakkar Mansaray (Sierra Leone). Honorary mention, UNESCO Prize for the Promotion of the Arts (1993).**



A world encyclopaedia of music

The International Music Council (IMC) is preparing to publish the first world history of music. Produced by an international team of specialists and entitled *The Universe of Music: A History*, the 12-volume work will cover all musical genres from all periods. The first volume, dealing with Latin America, is scheduled for publication in the first half of 1995. The *History* will be published in English by the Smithsonian Institution, Washington, D.C. (United States), before being translated into several other languages.

The IMC, a non-governmental organization founded in 1949 as a consultative body to advise UNESCO on music, regularly organizes meetings known as "rostra" to encourage traditional music, promote exchanges between the world's musicians and help young composers and musicians. Scheduled to be held in 1995 are international rostra for composers, in Paris; a young musicians' rostrum in Bratislava (Slovakia); and regional rostra in Korea, Colombia, Ghana and Tunisia. ■

The International Music Council, 1, rue Miollis, 75732 Paris Cedex 15, France. Tel.: (33-1)45 68 25 50; Fax: (33-1) 43 06 87 98.

UNESCO IN action

SVALBARD'S GIANT REPTILE

The world's northernmost museum is in Norway's Svalbard archipelago, which lies only a thousand kilometres from the North Pole and has a population of some 3,700. An old barn, a lot of enthusiasm and a little money were enough to provide a home for artefacts of great historical interest. The museum is devoted to both human history, especially that of whaling, which attracted many Dutch, British, Russian and Scandinavian fishermen to the islands in the 17th and 18th centuries, and natural history, especially the polar bear and other arctic animal, bird and plant species. The museum's pride and joy is its cast of a 60-cm.-wide paw print of an iguanodon, a giant reptile that lived in Svalbard 130 million years ago. A giant reptile living practically at the North Pole is enough to set anyone's imagination humming, but the fact is that the archipelago was once located near the equator and has slowly drifted northwards.

This and many other stories can be found in the June 1994 issue (N° 182) of UNESCO's quarterly *Museum International* devoted to museums of the Far North (from America to Greenland and Scandinavia to Russia). Published in English, French, Russian, Spanish and Arabic.

For further information contact *Museum International*, 7, Place Fontenoy, 75352 Paris 07, France. Tel.: (33-1) 45 68 43 39; Fax: (33-1) 42 73 04 01.

EXPOLANGUES, A VOYAGE OF LINGUISTIC DISCOVERY

The *UNESCO Courier* and its 30 language editions will be taking part in the thirteenth "EXPOLANGUES" Salon in Paris, which aims to link the study and practice of foreign languages with the discovery of others and to encourage contacts between people speaking different languages. The Salon, which will be held in the Grande Halle de la Villette, Paris, from 27 January to 1 February 1995, provides the opportunity for an intercultural encounter based on the idea that "the voyage that all students of language are invited to make is primarily a voyage of emigration from oneself".

For further information contact OIP, 62, rue de Miromesnil 75008 Paris. Tel.: (33-1) 49 53 27 60; Fax: (33-1) 49 53 27 88.

SCHOOLS FOR TOLERANCE

Wishing to give "a major priority in education to young people, who are particularly vulnerable to intolerance, racism and xenophobia", some 100 ministers of education and other officials who took part in the International Conference on Education in Geneva last October agreed to take steps to encourage the practice of tolerance in schools. Among the measures envisaged are including lessons on peace, human rights and racism in curricula at all levels; eliminating negative stereotypes and distorted views of others from textbooks; encouraging democratic school management involving teachers, pupils, parents and the local community; reforming teacher training by encouraging the participation of experienced personnel in human rights and democracy; and developing media education to prepare children for a critical analysis of information. The next International Conference on Education, in 1996, will focus on the role of teachers confronted by social and educational change.

WOLE SOYINKA, UNESCO GOODWILL AMBASSADOR

The Nigerian writer Wole Soyinka, Africa's first winner of the Nobel Prize for Literature (1986), was named a UNESCO Goodwill Ambassador on 21 October 1994. "His work in defence of freedom and human rights makes him particularly qualified to help UNESCO promote its programmes in culture and communication," said Mr Federico Mayor, Director-General of UNESCO. On 3 November, Wole Soyinka's United Nations laissez-passer (allowing him free exit from his country) was confiscated by the Nigerian authorities, provoking an immediate protest from the Director-General. On arriving in Paris after clandestinely leaving Nigeria, Wole Soyinka thanked UNESCO for aiding his efforts to leave his country, during a press conference organized at UNESCO Headquarters on 21 November by the International Parliament of Writers. ■

INDEX TRANSLATIONUM ON CD-ROM

The first CD-ROM edition of Index Translationum, UNESCO's guide to world translations, has just been issued and will now replace the paper edition. The Index provides a cumulative list of works translated and published since 1979 in more than 100 countries and covering every field (literature, social and human sciences, basic and natural sciences, art, history, etc.). It is a valuable instrument for rapid retrieval of references to works by more than 150,000 authors. Each entry includes name of author, title of the translation, name of translator and publisher, year of publication, original language, and number of pages. Also included is a trilingual (English/French/Spanish) user's guide. The disk may be used in a network.

Index Translationum, CD-ROM, 1994, (UNESCO Reference Books), ISBN 92-3-0022962-9, 1,100 French francs (airmail postage included).

PRESERVING AMERINDIAN LANGUAGES

Two books that preserve and celebrate the Amerindian languages of Peru and Mexico have recently been published with UNESCO support. Both are by 16th-century Spanish Catholic missionaries who studied the languages of the indigenous population in order to understand and convert them. The first, *Arte de la lengua mexicana* (1547, "The Art of the Mexican Language") by Brother Andrés de Olmos, is published with a critical interpretation by Asención and Miguel León-Portilla, who are leading specialists in the Nahuatl language. The second, written by Brother Domingo de Santo Tomás, is *Gramática o Arte de la Lengua General de los Indios de los Reynos del Perú* (1560, "Grammar or Art of the General Language of the Indians of the Kingdoms of Peru"). It is accompanied by an explanatory supplement by a linguist, Rodolfo Cerrón-Palomino. Both books have been published under the sponsorship of the Spanish Agency for International Co-operation, the Instituto de Cooperación Iberoamericana and UNESCO.

120 ARTISTS MOBILIZE FOR BOSNIA

A UNESCO-sponsored travelling exhibition entitled "Images for peace: a painting, a symbol", presents 120 works by contemporary European painters, sculptors and photographers. Each work in the exhibition, which is the brainchild of a French association named "Des images pour la paix", has been donated by its creator to the Sarajevo museum. This cultural and humanitarian gesture is intended to demonstrate the artists' solidarity with the artists of Bosnia and to help to maintain the tradition of freedom of expression and receptivity to the outside world in this war-torn country. Inaugurated in Paris at the end of 1994, the exhibition will be shown in several other cities in France and elsewhere in Europe (including Antwerp, Barcelona, Berlin, Geneva and Lisbon).

"Des images pour la paix", 27 rue de Charonne, 75011 Paris. Tel. and Fax.: (33 1) 48 07 07 79. ■

Johan Bojer

Men of little faith

The letter published below appeared in Correspondance, *the journal of the International Institute of Intellectual Co-operation, in 1934. In it the Norwegian novelist Johan Bojer (1872-1959) spells out the dangers of a divorce between public and private morality. His letter is a reply to that from the Chinese thinker Cai Yuanpei which was published in our December 1994 issue ('Religion and politics today', page 46).*

***Christ the King*, a mural painting (12th-13th centuries) in the Roman crypt of the cathedral of St. Etienne, Auxerre (France).**

To Mr. Cai Yuanpei

Oslo

Dear Sir,

You say that Chinese thinkers are extremely astonished by the idea that there should be one form of morality for the private individual and another for the state. And you call upon all those who wish to work for better co-ordination between the countries to organise their own lives so that they can provide a model of this.

If I understand you correctly, you mean that the world political and economic crisis can be reduced to a question of individual morality.

That reminds me of something that a Chinese philosopher wrote some thirty years ago about Western civilization. He stressed that the Christian countries have constructed a vast system which comprises a God in heaven, a devil in hell, and a third God who saved men by dying for them, whereas a thoughtful Chinese believes that the highest thing a man can aspire to is to behave well.

But it might well be asked: "What is meant by the expression *to behave well*? On this point Chinese wisdom and the Christian religion agree. To do unto others as you would have them do unto you. Confucius and Jesus Christ both believe that it is only by starting from the individual that the world can be improved. Start with yourself.

They would certainly not be happy if they were told: start with your own country.

This is because the great ideals are readily thought to be something unreal—something that can be discussed or professed and even written into an electoral programme. But who will accept that they commit him personally?

And so we have pacifists who wage war, priests who believe in the religion of charity but sow hatred of a neighbouring people and incite to vengeance and violence, and socialists who curse capitalism in public speeches but are themselves millionaires and live in great houses. One of the first things young people learn from their elders is: preach some great and noble idea but you will only practise it if you are a simpleton.

In 1914 there were two world powers which could have stopped the war. One was the Church, the other was socialism. Both had the duty to curb hatred between peoples and to assert that all men are brothers, in spite of frontiers. Both failed to do their duty. The two camps threw themselves into the slaughter.

A state does not need to behave well

A congress was held to lay the foundations for lasting peace, and at the same time surreptitious preparations were made for war. The delegates were suspicious of each other, knowing that it is praiseworthy to lie, deceive and commit perjury when you do so in the name of your country. The person who utters the finest words about peace is perhaps the representative of an arms factory and makes a fortune through war. We have reached the point where a man can feel delighted by another man's success while a state is jealous of others. A decision whose purpose is to be useful to everyone makes a patriot furious. How? Would his own country not profit from it? If the world can be saved from a new catastrophe by the disarmament of his own country, whose military power and prestige will perhaps be slightly reduced, this patriot is indignant. What treachery! Let the rest of the world go to the devil as long as your own country is on the winning side. A state does not need to behave well.

Is it forces outside mankind that are sending us the next war, that black cloud on the horizon which fills our nights with bloody ghosts? No! So can't men do anything about it? They don't dare. So do they want war? No . . . and yet . . they do.

For our thinking is chaotic. We profess humanism and venerate brute force. We love our brothers, and hate them too. We like to build, but we also like to destroy. The Christian believes—and does not believe—

Text selected by Edgardo Canton

in his doctrine. He talks movingly when he accuses capitalism of causing wars between peoples; but he preaches civil war himself.

A scientist may be pious and go to church on Sunday, but work for six days a week on the development of a new gas that will destroy a city in a few seconds. For he believes in God, and he does not believe in God.

Take a Christian pacifist who fought against weapons while he was in the opposition. Make him prime minister and everything changes. He has to choose between his own convictions and the machine. His country has become great and powerful because of wars. It must arm indefinitely to preserve its gains. Can the pacifist stop armament? No, he does not even want to do so. He also has tradition in his mind. He continues to manufacture guns, bombs and tanks. Nothing has changed.

We lack faith and we lack confidence.

We do not believe in political parties whose programmes are as garish as neon-lit advertisements. We do not believe in the press, for we know that it sows hatred and lies, with the sole aim of increasing sales. We do not believe in parliamentarians with their stock-in-trade of convictions, nor even in priests who all too often adapt their God to the needs of the government.

However, the glimmerings of a renaissance are starting to appear. The Oxford Movement,* for example, is a peaceful revolution against torpid Christianity and spineless idealism. It is Christian without building churches, formulating dogma or electing popes. It knows no frontiers and does not divide men into races or classes. Its religion is action. Its highest duty is to carry out God's will, that is to behave well.

When this movement, which is spreading more quickly than most people think, reaches parliamentarians and governments, we shall see even politicians feel confidence in each other, the disarmament conference will not end in an arms race and even states will start to behave well.

Hoping, dear sir, that you will excuse a peasant from such a small country as Norway, who has taken upon himself to impose on your time, I remain

Your respectful admirer,

JOHAN BOJER ■

* The Oxford Group or Moral Rearmament Movement was founded in the 1920s by Frank Buchman (1878-1961), who launched a worldwide evangelistic campaign for moral and spiritual revival based on God's guidance, moral absolutes and the "life-changing" of individuals through personal work.

anniversary

LOUIS

A pioneer of the modern era in medical science, Louis Pasteur died a hundred years ago, in 1895. Among his many great contributions to knowledge, he showed that micro-organisms cause fermentation and disease and developed vaccines for rabies and anthrax.

Louis Pasteur was one of the greatest scientists of the late nineteenth century. By creating the field of bacteriology, he revolutionized medical science. His discovery of the microbial cause of disease led to the introduction of asepsis in surgery (the sterilization of surgical instruments) and made possible the manufacture of vaccines. By establishing the Pasteur Institute at the end of his life, he also began a tradition of research and prevention that has had a far-reaching influence on Western medicine in the twentieth century.

He was born in 1822 at Dole in eastern France, and spent his childhood in the nearby wine-growing town of Arbois where his father, a tanner, set up in business in 1826. His secondary education took place in Besançon where he was no more than an average student. In 1843, however, he entered the prestigious Ecole Normale Supérieure in Paris. Around this time his work on polarized light led him to an important discovery that made his name. He noticed that the crystals of tartaric acid, a salt found in wine deposits, are assymmetric. He also discovered that living organisms, especially in the fermentation process, tend to produce molecules that are optically active. Studying the molecular structure of crystals more closely, he was led to differentiate organic from mineral substances. Starting out from chemistry, he had already reached the frontiers and mysteries of biology.

The researcher

Pasteur obtained his doctorate in chemistry and physics in 1847, and in the following year was appointed professor of chemistry at the University of Strasbourg. In 1854 he became dean of the science faculty at the University of Lille, where he began to study the fermentation of milk and alcohol. By asking such questions as how fermenting agents work on matter and where the microbes responsible for fermentation originate, Pasteur was examining the still-unresolved question of spontaneous generation, the theory that living organisms arise from nonliving matter. This theory, championed by Félix-Archimède Pouchet, director of the Museum of Natural History in Rouen, and others, was disproved by Pasteur.

In 1862 Pasteur became interested in the formation of vinegar, and in the following year studied the different forms of deterioration in wine. These studies led him to discover a way of preserving food by heating it below boiling point, thus preventing fermentation. This process, known as pasteurization, caused a revolution in the food industry.

From studying the microbes responsible for fermentation to the study of those that cause contagious diseases was a short step, one that Pasteur took in 1865 when he began a mission that led to the isolation of bacilli causing diseases that were decimating silkworms in the south of France and to the development of methods of preventing contagion.

In 1868, at the age of forty-six, Pasteur was semi-paralyzed by a stroke. In a lesser man this might have spelled the end of a brilliant career, but Pasteur was soon back at work. In 1871 he applied pasteurization to the preservation of beer and solved the storage problems experienced by the brewing industry. In 1873 he was elected a member of France's National Academy of Medicine

After 1877 Pasteur, working in close collaboration with Charles Chamberland and Emile Roux, devoted most of his time to the study of contagious diseases in the higher mammals. Using findings by C. J. Davaine, who had already isolated the infectious agent, he turned his attention to anthrax, a deadly disease in sheep and other animals, and eventually developed a vaccine against it. In 1879 he began to study chicken cholera and established procedures that served as a model

PASTEUR, *scientist and humanist* by Louise L. Lambrichs

A portrait of Louis Pasteur dating from 1845.

A LIFETIME OF RESEARCH AND DISCOVERY

1847-1849: Pasteur's work on crystals form the basis of stereochemistry, the study of the spatial arrangement of atoms in molecules.

1853-1857: studies fermentation, especially alcoholic and lactic fermentation.

1863-1871: develops "pasteurization", a method of enhancing the keeping qualities of liquid foods or beverages, which he applies to wine and beer.

He demonstrates the infectious and hereditary nature of pébrine, a disease affecting silkworms, and invents a system of selective breeding, thus saving the French silk industry.

1871-1879: research into ways of treating infectious diseases; he identifies the anthrax bacterium; the bacterium responsible for gas gangrene; the staphylococcus and streptococcus bacteria; the chicken cholera bacillus.

1880: He produces a successful inoculation material against anthrax, a disease of animals and people.

1885: first successful inoculation against rabies.

1888: foundation of the Pasteur Institute in Paris.

for his method of vaccination. His research into anthrax led him to discover the bacillus that is responsible for gangrenous blood-poisoning. Later he isolated the microbe subsequently known as staphylococcus, which leads to the formation of pus, boils and osteomyelitis, an inflammation of the bones and bone-marrow. This discovery revolutionized accepted medical theory, for pus had often been considered as part of the healing process rather than a pathological symptom.

Turning his attention to puerperal fever, which caused the death of many women after childbirth, Pasteur showed that its origins were microbial and convinced doctors and surgeons of the importance of asepsis. The practice whereby doctors sterilize their instruments and wash their hands before examinating patients, a direct result of Pasteur's researches, brought about a dramatic reduction in hospital mortality rates.

A benefactor of humanity

In 1881, at the height of his fame, Pasteur was elected to the French Academy. He now began to investigate rabies. After years of false starts and dashed hopes in the study of this terrible disease, his discovery of a vaccine against it crowned his life's work and has been widely regarded by posterity as the symbol of his achievements. About the same time Pasteur began a subscription campaign for the foundation of the research institute that would bear his name. Eventually, branches of the Pasteur Institute would be established in many parts of the world, where they became a training ground for researchers involved in the struggle against contagious diseases and the search for increasingly effective vaccines.

When, on 28 September 1895, Louis Pasteur died in Villeneuve-L'Etang, near Paris, he was mourned by the entire nation. The press paid lavish tribute to a "secular saint", and he was buried with full national honours.

What is so remarkable about Pasteur is not only the breadth of his approach but the fact that his work had a decisive impact in so many fields. He was not a dilettante or a brilliant jack-of-all-trades but a rigorous scientist with prodigious powers of synthesis. Science for Pasteur was one and indivisible. He made light of the boundaries between disciplines, and approached all the problems he studied in the same way, attempting to discover their hidden mechanisms and to reveal, through the laws that govern them, the inner logic that links living and nonliving phenomena.

Pasteur was the living symbol of the scientific progress that at the end of the nineteenth century seemed capable not only of conquering mortal diseases but of promoting the welfare of individuals and society. One of Pasteur's greatest strengths was his ability to defend the interests of science in the corridors of power. Unlike his mentor, Claude Bernard, who always maintained a low profile, Pasteur was convinced that the battle for science should be waged on the political front as well as in the laboratory. In this respect he was astonishingly modern. ■

LOUISE L. LAMBRICHS
is a French writer and philosopher whose published works include *La dyslexie en question* (1989) and (with Dr. Fabrice Dutot) *Les Fractures de l'âme* (1988).

LETTERS TO THE EDITOR

Genetic diseases and racism

When I read your September 1994 issue on bioethics I was amazed to discover (on pages 14-15) that certain hereditary diseases occur frequently among Jews. Could you give me more information about this?

Marie-Reine Boureau
Bléneau (France)

I learn from your issue on bioethics that Gaucher's disease and Tay-Sachs disease occur particularly often among Ashkenazi Jews and, in the latter case, among French Canadians.

I feel unhappy about these racial references in a bio-medical context and would like to know more.

Jean Chollet
Thésée
(France)

Genetic diseases are inherited. All populations may carry particular genetic diseases as the result of accidental mutation or because of a mutation's advantage in certain environments.

If a mutation occurs in a relatively isolated and rapidly expanding population group (Ashkenazi Jews or French Canadians), then that group may suffer from a much higher risk of the disorder. Such has been found to be the case with Gaucher's and Tay-Sachs diseases.

Research on genetic disorders has resulted in successful preventive medicine. In Sardinia and Cyprus, for example, the populations concerned have welcomed information allowing avoidance of the genetic risk of thalassaemia, a hereditary form of anaemia. As a result, the incidence of thalassaemia has been dramatically reduced.

It would be shameful to give up the curative and preventive power of modern genetics through fear of racism. Equally, we must avoid eugenic misuse of genetics: that is one of the most important tasks to which UNESCO *is dedicated.*

David Shapiro
Executive Secretary
The Nuffield Council on Bioethics
London (U.K.)
Member of UNESCO's International Bioethics Committee

The Casse-cou Steps

I should like to correct the caption to the last photo illustrating the excellent article on the city of Quebec which appeared in your May 1994 issue (*A new look at the history of communism*). The photo actually shows rue Petit-Champlain, not rue Notre-Dame as indicated in the caption. Above this street, the oldest in the country, are the famous "Casse-cou Steps".

Yves Laberge
Sainte-Foy, Quebec

Official abolitions of slavery

Congratulations on your excellent issue on slavery (October 1994), aptly described on the cover as "a crime without punishment".

The dates which you give in your chronology of the official abolition on page 30 clearly show how long it took before awareness of this evil phenomenon spread around the world.

I should like to make a correction with regard to Argentina. Although it is true that slavery was abolished there in the constitution of 1853, the first official act of abolition dates from 1813, when the Constituent Assembly proclaimed what was called "libertad de vientras" ("freedom of the womb"). After that date all children (including those of slaves) were born free, and anyone who arrived in the country also automatically became free.

M. Milchberg
Paris
(France)

Thank you for this interesting piece of information. As you point out, our chronology was restricted to measures of abolition adopted by countries on a constitutional basis. Editor

Rethinking economic development

On rereading the interview with Jean Malaurie in your April 1994 issue (*Modern management and local traditions*), I was struck by what he said about the inevitable nature of world economic activity.

He makes me think of the proverb (Indian, I believe), which says, "If you give a man a kilo of grain you will feed him for a day. If you give him a sack of grain you will feed him for a month. If you teach him to grow wheat, you will feed him all his life", but in that case, I would add, "the wheat-farmers of the Middle West would not be able to sell their wheat to the Indians".

Isn't this the biggest paradox of our time?

We want to help the developing countries by bringing them Western technology, with the attendant risk of cutting them off from their roots and the certainty of closing their markets to our products, which they will manufacture themselves and try to export.

How can the leaders of Europe, and above all those of the seven most industrialized countries, be made to understand that economic development should be envisaged on a world scale?

I think that this is bound to be, in the early twenty-first century, the major debate on economics and culture.

Paul Marguin
Chaudes-Aigues
(France)

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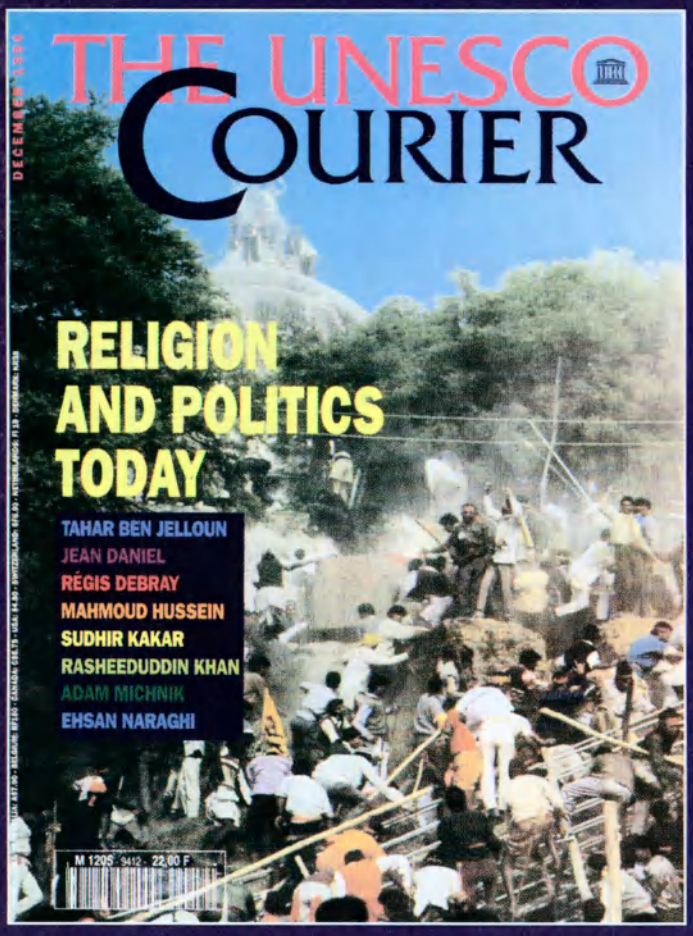

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THEME OF THE NEXT ISSUE (FEBRUARY 1995):

COMMUNICATIONS

INTERVIEW

WITH THE FRENCH WRITER AND PHILOSOPHER RÉGIS DEBRAY

ENVIRONMENT

ROAD TRAFFIC AND CLEAN AIR— AN INCOMPATIBLE COUPLE?

HERITAGE

THE INDIAN TEMPLE OF TANJAVUR