

Music

Mathematics Of Ragas

WHEN Frenchman Bernard Bel and American Jim Arnold met by chance in a Delhi hotel in September 1979, it turned out to be a momentous occasion for Indian music. In the two years since, Bel and Arnold have together embarked on an ambitious research of Hindustani classical music's vast oral tradition along mathematical lines. Never before has a similar scientific enquiry been conducted into this tradition, and by doing so the two researchers hope to achieve two ends: the preservation of Indian music's purest forms and the application of their work to the loosening traditions of Western music.

Bel's interest in Indian music began in 1969 when he heard an old recording of Mohinuddin and Aminuddin Dagar. Arnold was hooked from the time he heard a record of jazz flutist Bud Shank and sitar maestro Ravi Shankar together in 1964. An electronics engineer, Bel began to investigate the science and the psychology of sound on the human brain.

Like many Westerners, Bel had been captivated by the intimacy of Indian music, in which a tabla player provides the rhythm, a tambura provides the basic drone, and the central figure is the vocalist or instrumentalist. Meditative and self-transcendental, Indian *ragas* (the word means colours) refer not only to a scale but to a melody type, and produce instantaneous emotional effects, called *rasas*. Bel began conducting experiments along with a Ravi Shankar disciple, blind Nepalese sitarist Narendra Bataju, in Paris, and deduced that 'ear training' in Indian music was far more precise than that in the Western styles.

Firm Foundation: Meanwhile, Arnold was acquiring a solid musicological foundation. Initially studying Indian music under the late Dr Lal Mani Mishra at the University of Pennsylvania, Arnold followed his guru back to Banaras Hindu University (BHU) in 1973. There, alongside the study of ancient musical tracts like the

Natyashastra (4th century B.C.) he also took up an apprenticeship under Amiya Nath Bhattacharya, a respected exponent of the Seniya *gharana*. "Bhattacharya forced me to understand," says Arnold, "that to produce a series of exact notes one had to exert tremendous concentration—and that opened up the mind and music literally poured out." Arnold now understood the importance of *shruti*, very precise notes that dictate intonation and form the purity of vocal music.

In 1974, Arnold devised a mathematical circular model, akin to a slide-rule, that provided explanations of *ragas* performing



Arnold (left) and Bel with the Apple microprocessor

time and showed that 95 per cent of Indian melodies followed "a deep inner logic in the intonation of their scales and their melodic movements". Arnold also discovered that many Indian melodies went in pairs: for instance, Bhimpalasi and Bageshree had similar scales, although Bhimpalasi is an afternoon melody with very bright notes and Bageshree is a late-night melody with very sombre notes.

The Delhi meeting in 1979 therefore brought theoretician and scientist together, or, as Arnold puts it, "brought the bread into contact with the butter". Encouraged, Bel returned to France and, after toiling for over 1,000 hours and piecing together 150 integrated circuits (ICs) he constructed an instrument he calls the '*shruti* harmonium', which produced hundreds of very pure notes, although theory has it that there cannot

be more than 22 *shrutis* or pure notes. Today, Bel merely has to be told frequency and tempo ratios by a musician, and he enters it on a small calculator keyboard; the instrument then gives a very accurate note position corresponding to this ratio.

Crowning Moments: Bel's exhibition of his invention led to Arnold joining him in Paris in early 1980. There, the two men presented their ideas to a galaxy of musicologists, acousticians and scientists, and proposed that their in-depth scientific study of an ancient Indian musical system would help the West solve questions about playing modern Western music in pure intonation. "A purity that has been drowned by huge orchestras, and sound-effects like roaring cannon, tinkling glass and bird calls," frowns Arnold. "This way," says Arnold, "the West would derive the benefits of a 2,000-year-old tradition." The crowning moments came in the autumn of that year when music teacher Ginette Keller played Bach chorals on Bel's *shruti* harmonium at the Conservatoire National in Paris, and moved by the pure intonations, her students rose in spontaneous ovation.

Bel and Arnold returned to India in late 1980, armed with a seed grant from Unesco's International Fund for Promotion of Culture; later, they obtained collaborative funding from the Sangeet Research Academy in Calcutta, which is run by the India Tobacco Company (ITC).

The most dramatic moment for the two men came in November 1980 when they met Fahimuddin Dagar, one of the most knowledgeable members of the venerable Dagar family, at a Dhrupad *mela* in Brindavan. Fahimuddin steered their research in the proper direction, and Bel and Arnold decided to concentrate on the Dagarbani style of the Dhrupad school of Indian music. It was a wise decision, for the Dhrupad school is the most ancient one in India, dating back to the time of Nayak Baiju and Nayak Gopal (12th century A.D.). The Dagar family on its part traces its descent from Emperor Akbar's court: its ancestors Masnad Ali Khan and Surgyan Khan were among the emperor's *navratnas*.

Electronic Marvel: Today, Bel lives in Delhi, perfecting yet another electronic marvel, the Melodic Movement Analyser (MMA).

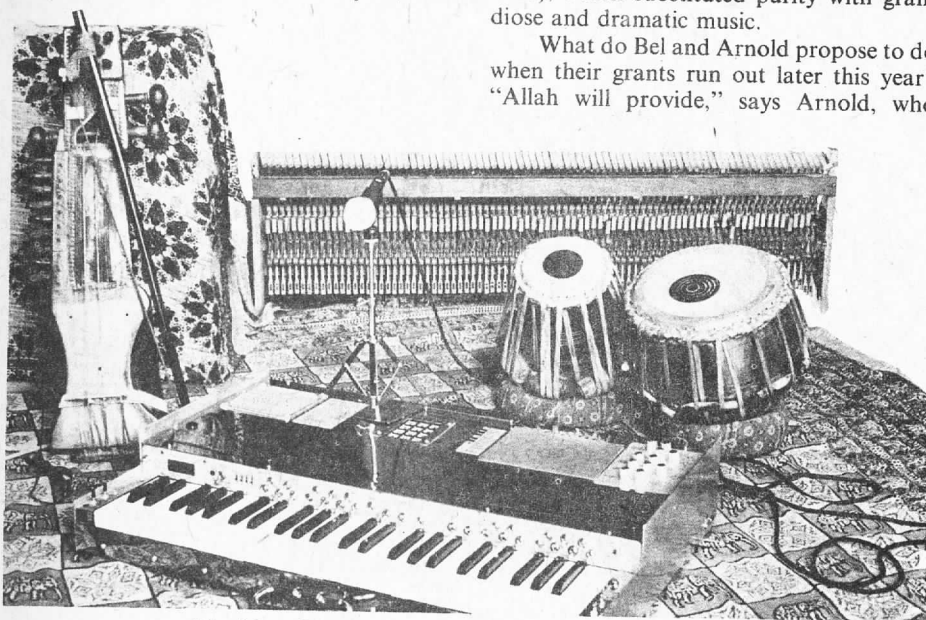
which in effect is an 'electronic microscope' for music and can 'see' musical sound at a speed of about 100 times per second. It is linked to a small Apple microprocessor with a TV screen, and Bel stores programmes for the computer on ordinary cassette tapes. The MMA accurately measures the pitch, time and spectrum distribution of every note. For instance, if a tambura's notes are processed through it, the computer screen displays a graphic image, with the sound represented in waves patterns. Some day in the future, students will be able to use the MMA to check how well they follow their teachers' precise instructions by coordinating their voice images on the computer screen, with those of the teacher.

In this respect, Bel and Arnold are not out to create an archive of music: that is being done by the Sangeet Natak Academy and other bodies. Their quest, on the contrary, is to show "what melody is, how

lapse of the Mughal empire musicians dispersed to lesser courts. Independence finally put an end to aristocratic patronage, and musicians were forced to depend on support from the *nouveau riche* and the uninitiated masses. "People today look at ragas as mere combinations, without understanding their deep grammar," says Arnold.

Hindustani classical music is not written down, but improvised upon a framework. In effect, therefore, a composition exists only in its performance. Sadly, this tradition has steadily lost many of its best exponents, and the accent today is on speed rather than understanding. Bel and Arnold's research may therefore help store the purity of this tradition and render it reproducible. This in turn will vastly help Western musicologists, for Western music has long ago lost its mathematical purity—a process that began with the onset of the Baroque era (1600-1750), which substituted purity with grandiose and dramatic music.

What do Bel and Arnold propose to do when their grants run out later this year? "Allah will provide," says Arnold, who



The 'shruti' harmonium (foreground) that Bel invented

melodies are grouped into families, what the psychological effects of particular melodies are, and what the principles of grammar of the Indian language of music are". Their research is therefore distinct from the mere collection and codification of melodies, a system perfected by Vishnu Narayan Bhatkande.

Both men are dismayed at the deterioration in pure musical tradition in India. "What I find shocking as a foreigner," says Arnold, "is that India is trading in its genuine culture for a plastic mass-marketed imitation. It is going in for Formica instead of good wood, and musical purity is being replaced by good showmen."

Steady Decline: This is very true. The Dhrupad school, with its serious, strong and spiritual music, dominated the Mughal court. After the 1857 Mutiny, and the col-

lapse of the Mughal empire musicians dispersed to lesser courts. Independence finally put an end to aristocratic patronage, and musicians were forced to depend on support from the *nouveau riche* and the uninitiated masses. "People today look at ragas as mere combinations, without understanding their deep grammar," says Arnold.

Meanwhile, their romance with India deepens with each day. Bel's wife Andreine is learning Kathak from Birju Maharaj and has named her son Tansen. In Calcutta, Arnold converted recently to Islam, took the name of Wasiuddin, and married Fahimuddin Dagar's youngest sister Nazneen. Bel is thinking of patenting his inventions and eventually selling them to research institutions. Above all, by combining pure science and an ancient performing art, the two men from different continents are proving that music is indeed a universal language.

—CHAITANYA KALBAG

IF YOU ARE FULLY DISHEARTENED

Consult
PROF. P.G.A. NATH

A WORLD
RENOWNED
PALMIST,
ASTROLOGER
AND
TANTRIK SAMRAT

**TO SOLVE
YOUR PERSONAL
PROBLEMS REGARDING**

- LOVE MARRIAGE ● SERVICE
- TRANSFER ● LITIGATION
- PROMOTION ● WEALTH
- HUSBAND WIFE AND FAMILY
- DISPUTES ● BUSINESS ● HEALTH
- FOREIGN TRAVELS
- MENTAL PEACE ● VIGOUR AND
- VITALITY ● FEAR TENSION & ETC.

**BE MERRY BY
HAVING MARVELLOUS
'SIDDH JANTRAS'**

SPECIAL	RS. 1475/-
DELUX	„ 1675/-
SUPER DELUX	„ 2175/-
HIGHPOWER	„ 2575/-
SUPER	„ 3100/-
DELUX POWER	
HIGH SUPER	„ 3775/-
DELUX POWER	

**THESE ALL JANTRAS
ARE FULL OF PUJAPATH,
SIDDHI AND MIRACLES
AND SOLVE EVERY TYPE
OF PROBLEMS.**

PALM READING	RS. 700/-
PER QUESTION	” 350/-
LUCKY STONE	} ” 1150/-
CONSULTATION	
NEW BUSINESS	} ” 1000/-
CONSULTATION	
V.P.Ps ALSO SENT ON 50% ADVANCE PAYMENT	

CONTACT :-
PROF. P.G.A. NATH
62-63/A, KAMLA NAGAR
DELHI-110007
PHONE 220974
TIMING : 8 A.M. TO 8 P.M.
WEDNES DAY CLOSED