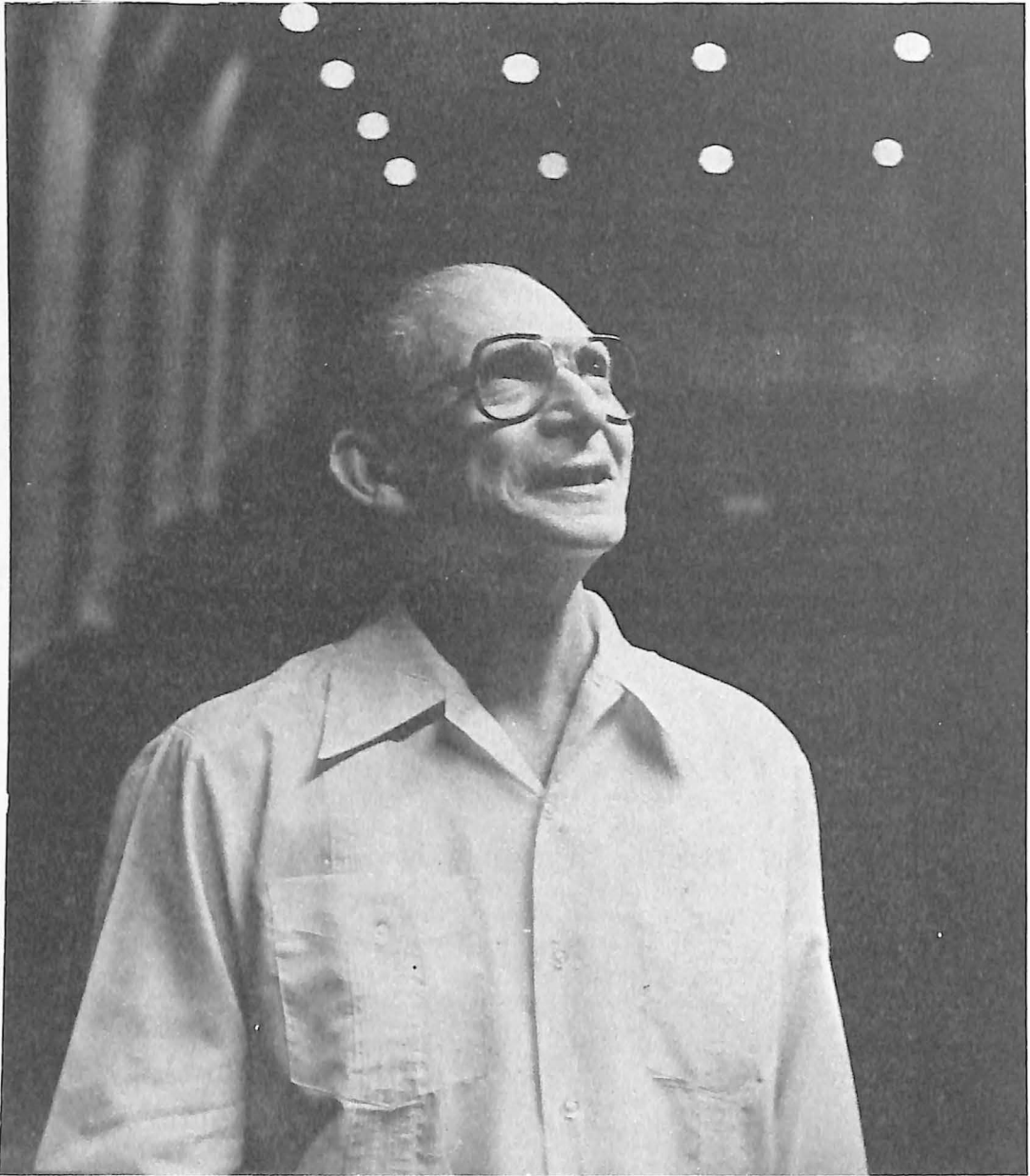


## Interview with Prof. Cyril Harris



[Professor Cyril M. Harris, the well-known authority on acoustics, has worked as Acoustic Consultant on many important projects. These include, among others, the John F. Kennedy Center for the Performing Arts,

Washington; the Metropolitan Opera House, New York; the Avery Fisher Hall (1977 reconstruction), Lincoln Center, New York. He is the author of several authoritative books on architectural acoustics, noise control and related subjects. Prof. Harris was interviewed at the National Centre for the Performing Arts by the Editor of the Centre's *Quarterly Journal*.]

Q. : *It is said that you accept only one in ten of the assignments offered to you? What was there in this assignment that you agreed to accept it?*

C.H. : I am a professor at Columbia University full-time so that I only have time to accept a few consulting assignments; and this must be done on a highly selective basis for I do all the work myself. They have to be jobs of particular interest to me. This assignment provided a most unusual challenge because a hall of this type had not been designed before.

Q. : *In a performing arts center, does an architectural design influence the acoustics or is it vice-versa?*

C.H. : The architectural design of a performing arts facility must be based on acoustic considerations. An architect should not design an auditorium and then correct its acoustics. At the beginning of design, the shape of the hall, the volume of the hall, the boundaries of the hall, the materials used in the hall should be determined by acoustic considerations. For a concert hall for symphonic music, I recommend the traditional rectangular shape. For an opera house, I use a different shape which is, in part, determined by the seating capacity. Depending upon the use of the hall, the shape and also the volume of the hall are determined by acoustical requirements. In addition, the shape of the walls and ceiling of the hall greatly influence its acoustics. That means then that the architect must fit his design to these requirements. There are many, many architectural solutions that can fit these acoustic requirements, and the problem is to find a solution which will please the architect and please me as the acoustical consultant. For example, on this hall we went through many ceiling designs. At the very beginning, I set certain acoustical requirements: for example, that we needed surface irregularities of a given size and shape tilted at certain angles. There might be dozens and dozens of architectural designs that could do this. Instead of having sharp angles they may have been slightly curved and aesthetically the designs would look completely different.

Q. : *And in this case it is what? The solution?*

C.H. : In designing a hall, for the performing arts, the acoustical requirements determine how the hall should be designed. From the very

beginning, the acoustical design of Tata Theatre was based on optimum conditions for the performance of traditional Indian music. This fact determined all aspects of the design. That doesn't mean that other types of music can't be played in the hall. But fundamentally it is designed for Indian music and dance. For western music, we would have used a different shape. Let me explain. When I first visited India and attended performances with Dr. Menon, I realized how important was the visual contact with the performer. The shape of a hall for western performances simply does not work as well; it puts too many people too far away. The shape that we have here brings the audience much closer to the performers, so that the performers can see their expressions. This is quite important. Another thing was quite clear to me, right from the beginning, in listening to performances of Indian music. I concluded that it was important to have lower reverberation time than would be used for performances of western classical music. This, too, influenced the acoustical design. Also, if this hall were designed for performances of some types of western music, a proscenium (with a stage behind) might be used. Where you have such a proscenium, much of the sound goes into the space behind the proscenium and is lost. This meant that for traditional Indian music, a proscenium just wouldn't work, because instruments, such as the sitar, do not radiate much acoustic power. So, right from the beginning, we rejected the idea of a proscenium. Now the lack of a proscenium will not hamper in any way the use of the hall for traditional Indian performance, or, in fact, for performances of many types of western music which require the kind of intimacy that Tata Theatre provides. 'Intimacy' is a very difficult thing to achieve in an auditorium. There are no fixed rules that can be set down which tell you how to design a hall so that it will be intimate. For a 1000-seat auditorium, I have the feeling that Tata Theatre is very intimate. One gets the impression that the capacity is much smaller.

*Q. : So avoiding the conventional proscenium has been a help? It was absolutely necessary?*

*C.H. : In the design of Tata Theatre it was absolutely necessary in order to achieve results of the highest quality. Where a proscenium is used, a large amount of sound is lost backstage. In this hall there is a thrust stage which comes into the auditorium and seals the area behind the performers with a reflecting surface. So all the sound, some of which would otherwise be lost, is reflected to the audience without any hindrance. The shape of the stage itself is designed to equalize the sound throughout the hall. But before we go any further, let me explain the reason for the steep slope of the seating in the auditorium. That comes from my research into Ancient Greek and Roman theatres. Acoustical studies of these theatres have shown that if you have a sound source close to an absorptive surface (such as a seated audience), the sound decreases much more rapidly as you go away from*

the source. But if you elevate the source, or if the seating has a very steep slope, as in Roman theatres, the sound reaches to the back of the theatre without dragging over the absorptive surface formed by the audience. Therefore more sound reaches the rear of the hall. There were two other measures taken to equalize the sound. Firstly, we used the shape of the reflector on the stage to direct more of the sound towards the back of the hall. Secondly, we used the ceiling surface to scatter sound throughout the hall.

Q. : *Hence the tetrahedrons on the ceiling? There is a lot of interest in them. Was it possible to use these plaster shapes because they could be fabricated on the ground, the availability of cheap labour making the solution more feasible?*

C.H. : In America, we would construct an irregularly shaped ceiling using plaster on metal lath. This type of lath is not available here except at great cost. Here it was much cheaper to cast the individual units and avoid the use of metal lath. It was much the more sensible thing to do. Not because of the cost but primarily because of the availability of materials.

Q. : *So this is what underlines the principle of the ceiling design?*

C.H. : The shape of the ceiling was designed to scatter sound throughout the hall, so that it is an even distribution. This scattering principle is what makes some of the halls built in Europe a hundred years ago (or more) much better than many modern ones. The style of architecture provided ornamentation of all different shapes and sizes which scattered the sound evenly throughout the hall. If this ornamentation were eliminated so that the ceiling and side-walls were smooth, you would have some places in the hall where you would hear much better than the others.

Q. : *I understand that elaborate precautions were taken to prevent noise and vibration from entering Tata Theatre? Why was such an isolation not thought of as necessary from the side near the sea?*

C.H. : Before we discuss this question, let me explain why noise is bad in a performing arts center. For music, noise decreases the dynamic range of the music that you are able to hear, because you are not able to hear the very soft notes on account of the noise. Now for speech, noise (in the auditorium) decreases your ability to understand what is said; for speech intelligibility does not depend upon how loud the speech is but how much louder the speech is than the background

noise. So if the background noise increases in level then you must talk that much louder to be heard equally well. So there should be as little noise as possible in the hall. Now from the sea we didn't expect very much in the way of noise sources. It's true that if a boat were moored near the hall and blew a loud whistle or horn, you could possibly hear it. But from the economic standpoint, you can provide only so much sound isolation. On the other hand, protection has been provided against noise from automobiles and trucks which are much more of a menace.

Q. : *How would the Elevator Block, which is an addition to the main building, interfere with this isolation?*

C.H. : The Elevator Block itself is built as a completely separate building. There is a one inch airspace between the Elevator Block and the concert hall itself. This was done to prevent elevator vibration from being transmitted through the building structure to the concert hall—the vibration cannot pass through this gap.

Q. : *What do you think of the actual execution of your concept? Are you satisfied?*

C.H. : Oh, yes. Everything seems to work very well. For example, sometimes when an auditorium is built, you find that a great deal of time and money has been spent to ensure that there would be no noise from the air-conditioning system, and yet you hear noise, so that corrective work must be done. In Tata Theatre, the execution of the design was very successful; this hall is very quiet. You don't hear any air conditioning noise.

The quality of the workmanship is very nice. I like the looks of the finished material, for example—the plastering. Obviously when you first move into any building there are little things that need to be put right, but these are a minor consideration here.

Q. : *We found that sounds in the auditorium—a cough, the jingle of bangles, the clicking of cameras—are heard so clearly that they disturb the audience and probably the artiste. Is there any way of tackling the problem?*

C.H. : The answer is that the audience must learn to avoid making noises that will disturb others. In an ordinary hall, because the acoustical conditions are poor and the noise level is high, such noises are usually not obvious, but you can't hear the artistes that well either. But in a

hall of acoustical excellence, it is important that the audience be relatively quiet. For example, after the Kennedy Center opened, a music critic wrote during the first week, "You know, our audiences are going to have to be quieter than they have been in the past." I hope that audiences here will realize this when they can hear someone talking eight rows away and that, with experience, they will become quieter.

I have a feeling that all over the world television has had a very bad influence on the behaviour of audiences. They are so used to watching a TV performance, while talking or answering telephone calls, that they also talk when they go to public performances, making the performance far less enjoyable for those seated near them.

In New York City, at the old Metropolitan Opera House, many women made it a point to arrive late, so that people would notice their new dresses. Mr. Bing was outraged by this. When the Met moved to the new opera house, he said, "If you aren't there at the start of the performance you will be locked out until the first break in the performance." The first day people were locked out and they were outraged. They were locked out for the first week and they were outraged. Then they realised the policy wasn't going to change and they started coming on time. This was hard on the latecomers but this policy is of great benefit to the audience as well as the performers.

*Q. : There is another question that people raise: whether the cost for perfect acoustics is justified?*

*C.H. : When I first started work on this project, I felt confident that it was possible to design a hall of excellence for traditional Indian music. You had asked me earlier on why this particular job attracted me. There were two considerations. The most important point was that I had understood that there had never been a hall specifically designed for unamplified traditional Indian performances. This to me seemed like a big challenge. And I like working with Philip Johnson and John Burgee. So I felt confident that it was possible to provide a hall of excellence. What does a hall of excellence mean? If, on a scale of one to ten, ten is perfect, I would say maybe nine-and-a-half would be excellent. And I felt it was possible to come up with nine point five. After listening to the performances in the new Tata Theatre, my genuine feeling is that this hall is a perfect ten. That's something one hopes to achieve, but has rarely been achieved. There is nothing I would want to change as far as the acoustical design of this auditorium is concerned. One important thing to emphasize is that even with a hall with a perfect rating of ten out of ten, the hall itself cannot make up for something that isn't there. If there are imperfections in playing, you are going to hear them. If a person speaks in a very low voice, so that he can't be heard even in a large living room, natu-*

rally, even in a perfect hall under the most favourable conditions, it will not be possible for 1,000 people to hear him. I would say the hall has achieved in every respect what I expected it to achieve.

The objection to the expenditure of money for the performing arts is not unique to India. For example, at the Kennedy Center, when it was first proposed, there was much argument against it. Some people said, "Why should so much money be spent on facilities for the artistes? Instead, why not give it to artistes who are having a struggling time?" Besides, they argued, Washington is not a cultural community. People won't go. We went ahead and it was constructed. Well, what has happened is that these artists (who didn't have a job, didn't have any place to perform) now have, on some days, three concerts in the same hall. The place is busy all day long. The artists are now provided with a place to work and it has generated much more interest in the arts. As a matter of fact, some of the politicians, who said it wouldn't be used, who called it a white elephant, are now complaining that they can't get tickets! In other communities, in Minneapolis for example, they didn't have a good hall to perform in. With a new hall of acoustical excellence, the number of performances has gone up by a factor of five. I really think that it is wrong to say that money spent for any performing arts centre isn't money well spent. This is, in fact, a way to generate more interest in the arts, to give the artiste a better chance to make a livelihood. I think it is particularly important here because if much of the Indian heritage is to be preserved, it is going to be dependent on recording of performances. And you cannot record a performance in a noisy hall with poor acoustics. This hall provides an excellent performing facility in which to record what's going on here for the future. One of your goals, one of the initial considerations, was recording, preservation, documentation.

Q. : *When people complain about high costs, they have many things at the back of their minds, but that's our problem. We have to tackle it and, of course, it has nothing to do with acoustics.*

*When I watched Shakuntala from the last row in E Block, the actor was at times almost diagonally across from where I was. When he spoke his lines straight, I could hear him very clearly. When he turned, some of the sound was lost. Will this always be a problem when one is placed at that point in the hall?*

C.H. : Let me say this. One of the things you cannot do is violate the laws of physics. The voice, at the higher frequencies, is directional so that when a talker or singer directly faces a listener, the listener will hear the higher frequencies more clearly and you can't change this. For example, I remember seeing *Madame Butterfly* at the Metropolitan

Opera House. When Butterfly commits *harakiri*, she was doing this. [Prof. Cyril Harris demonstrated the way the singer whirled as she sank to the floor.] Every time she directly faced the audience, as she whirled around, the voice was louder; then it became softer as she turned away. To me it was very dramatic. So it's true, there really isn't any way . . .

- Q. : *Acoustically, yes. But visually? Suppose we tell the artistes what the problems are. Do you think they could work out a design bearing this in mind?*
- C.H. : Visually you see something different from various seats in a theatre with a thrust stage, such as the one at Tata Theatre. From the side, the view is different than from the front. But to me it was just as interesting . . . I think that you need not design a set the same way for the thrust stage. You have to design a set with the idea that it can be seen from all sides.
- Q. : *The set for this play was designed for a front-of-the-stage production and there was neither the time nor the money to make changes, re-do it for this particular performance. Besides, if changes had been made, they wouldn't have been able to use the new set elsewhere. Considering all this, it worked remarkably well.*
- C.H. : I'll tell you what they do at one theatre of the Kennedy Center. The hall has a stage not unlike the one you have here. There is no proscenium—it's an open stage. When a group is coming from elsewhere, they are sent a floor plan, printed in detail, so they know in advance the shape and size of the stage. Thus they can make plans for using that before they come to the Center.
- Q. : *We have done the same. There is a Korean ensemble coming and we have sent them all the specifications, exact measurements, drawn to scale, the size, shape, elevation etc.*

*A last question, going back to what you told me right at the beginning. You said that one reason you accepted a project like this*

*one was because you liked your students to benefit from your experience in the practical aspects of acoustical design. As a result of your experience on this project, what will you have to transmit to your students?*

C.H. : I think that my students are very much interested in the following question: Why was it necessary to design differently for traditional Indian music than for western music? To them that is a very interesting question; its answer presents the opportunity of reviewing the whole question of the acoustical design of a performing arts center.

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