Stage Acoustics in Concert Halls: My Experience with Danish Radio Concert Hall

By Dr. Yasuhisa Toyota

January 20, 2014 marked the 5th anniversary of the opening of Danish Broadcasting Corporation's Danish Radio Concert Hall (DR Hall). (Our March, 2009 newsletter for the opening.) The concert that evening wasn't a special gala, but a regular season concert. I had the pleasure to attend it and a post-concert reception. The DR Symphony Orchestra is the resident orchestra in the hall and plays all of its rehearsals and concerts there. The relationship of the hall to the orchestra and to the Danish Broadcasting Corporation is similar to that of NHK Hall, the NHK Symphony Orchestra and the Japan Broadcasting Corporation. However, NHK Hall is a multipurpose hall, not a concert hall and the NHK Orchestra typically rehearses not in its hall but, instead, in a separate rehearsal hall. The DR Symphony Orchestra's ability to rehearse in its hall and the concert hall acoustics of the space are distinguishing operational and acoustical characteristics of DR Hall compared to NHK Hall.

Figure 1: Danish Radio Concert Hall

DR Hall has a vineyard style configuration and seats 1,800 persons. Berlin Philharmonic Hall is an early example of the vineyard configuration. Suntory Hall in Tokyo and Walt Disney Hall in Los Angeles are two of the many examples of halls with this shape designed by Nagata Acoustics. In a vineyard configuration, the audience seating surrounds the stage in a tiered arrangement of banks of seating-sometimes likened to the small plots of land of specialty grape vineyards. Other examples of halls designed by Nagata Acoustics and similar to DR Hall's interior layout include Sapporo Concert Hall "Kitara" and Muza Kawasaki Symphony Hall.

The DR Hall stage has two movable acoustics-related features: (1) electric-powered orchestra risers across the entire floor of the stage, including under the string sections, and (2) a suspended acoustic canopy installed in the open space above the stage. The acoustic canopy can also be raised or lowered using electric power. We designed the canopy with an electric motor to enable easy access to lighting fixtures, microphones and other equipment that are also located above the stage. Unlike the orchestra risers that the orchestra adjusts to different heights depending on the orchestra configuration and music program, Nagata Acoustics' intended the electric-powered canopy to be moved only by technicians servicing lighting fixtures, microphones and other suspended equipment.

We determined the optimal height of the suspended acoustic canopy during our room design of the hall and expected this height to stay unchanged for orchestra rehearsals and performances regardless of the repertoire or configuration

of performers. Our design planning did include a scenario in which the orchestra might adjust the height of the canopy ever so slightly using the electric power provided and this possibility was taken into account during the canopy's design.

Needless to say, it's human nature that if you design something so it can be moved, someone will want to try moving it. Among the orchestra's players, those with a strong sense of curiosity expressed the desire to experiment with the height of the acoustic canopy as well as the heights of the risers and these musicians energetically persuaded the orchestra's management to let them change the height of the canopy. Both Danish Broadcasting Corporation and the orchestra's management considered the request a simple one and they too thought it fine to freely play around with the canopy's height.

Figure 2: Suspended Acoustic Canopy and Orchestra Risers on Stage

The Nagata Acoustics team responsible for the project only learned about the canopy height experiments after the orchestra players had tried out a number of different configurations. Trying out different heights for the canopy put the orchestra into a state of confusion. The orchestra's players could not agree on the best height for either the canopy or the stage risers. If one player preferred a certain low height another player disagreed and preferred a specific high height. One might say that the opinions were "all over the map" with the orchestra unable to reach a consensus.

Likewise, the conductors expressed a range of preferences. It was impossible to gain a consistent recommendation from the conductors who perform with the orchestra and this contributed to the rather extreme state of confusion about how to proceed.

In general, evaluating stage acoustics is a tricky business and this becomes even more complicated when the ensemble evaluating the stage acoustics is an orchestra. An orchestra contains a great variety of instruments and their location on stage within the orchestra creates a unique environment for each player. The music parts played by each musician differ from the parts played by their colleagues and the conductor plays a critical role in how the orchestra sounds and performs. Each musician comes to his or her opinion of a stage's acoustics through the context of a complex set of conditions that varies from musician to musician.

Another complicating factor is the phenomenon that as the musicians gain experience on a stage, their evaluation of the stage acoustics changes. Even on exactly the same stage and under the same conditions, as the musicians gain more experience practicing and performing in the space-that is, as time passes-their opinion of the stage acoustics changes.

It's not unusual to hear or read about "the best on-stage acoustics". However, there is no one-size-fits-all solution for the "best stage acoustics". For example, the acoustical characteristics on-stage at the Vienna Philharmonic's

Musikverein differ significantly from the on-stage acoustics at the Berlin Philharmonic's Philharmonie Hall. For each orchestra and each hall, there are unique stage acoustics that enable the orchestra to comfortably play at its best.

When I was contacted by the DR Orchestra about the confusion and dilemma that experimentation with the stage canopy had created, I immediately advised an end to the experimentation and requested that the acoustic canopy be moved to the height specified in our design documents. I recommended that the originally specified height be used as is for at least one full year without making any adjustments. After the orchestra would invest this period of time to gain experience in the hall, if necessary, small, incremental adjustments could be considered, keeping in mind that achieving the best on-stage acoustics requires following the essential and important process of practicing and performing on the stage over a period of time.

When I visited the hall in January for the concert on the hall's 5th anniversary, considerable time had elapsed after the series of events that began with the orchestra experimenting with the canopy's height, becoming confused about the proper height, contacting Nagata Acoustics and implementing our prescription of a "no changes at all" period. After the January 20 concert, I participated in a productive meeting with the orchestra players and Danish Broadcasting Corporation representatives. I learned that the orchestra players' temporary dilemma was for the most part a thing of the past. The orchestra has settled into the on-stage environment. Nagata Acoustics' role is now to be available to the orchestra to discuss-if necessary- how adjusting the position of the acoustic canopy would affect the on-stage acoustics and to work with the orchestra as it cautiously considers if this is a possibility it wishes to pursue.