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MULITPURPOSE - MULTIFORM, THE TREND.

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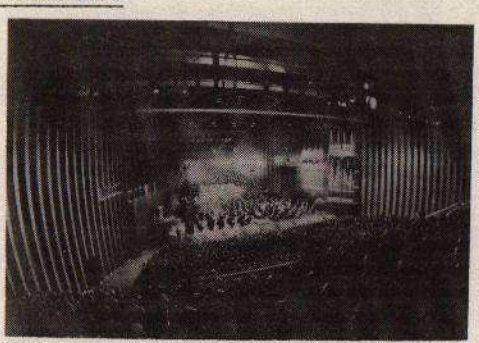
INTRODUCTION

Singel purpose halls doesn't exist, only multipurpose exist.
Earlier recorded halls are taken as examples.
New halls under construction are used to illustrate the importance of:

- establishing with the client a priority list of usage.
- how multiform can accommodate multipurpose.
- designing an electroacoustic system to provide for lower listed priorities.
- establishing the values of room acoustic criteria to be met for the prime purpose.
- variable acoustics as a tool for obtaining satisfactory roomacoustic conditions for lower listed priorities.

EARLIER HALLS

Oslo Konserthus



This hall was originally designed as a singel purpose Concert Hall and it is descriped in "Acoustical Design of Concert Halls and Theatres" (1). It is mentioned how the hall turned out to be used in reality, when the management were forced to produce an income. Show-type performances were almost given first priority and a proscenium type velour-curtain arrangement with soffits and legs, lighting facilities and a complete new sound system was designed. These systems now functions very well. The curtains can be arranged in different ways according to the type of performance, and they provide the essential dampning of the stage area, when multi-miking is in use. The sound control is moved to a permanently placed mixing console at a central position at the back of the stalls. The reverberation time (RT and EDT) and clarity changes considerably with and without the use of the curtains as will be seen from the following average values (315-1600 Hz):

	RT(sec.)	EDT(sec.)	C(dB)	LE
Concert hall originally:	2.10	2.10	-3.6	0.36
Concert hall with curtains:	1.70	1.60	-0.5	0.36

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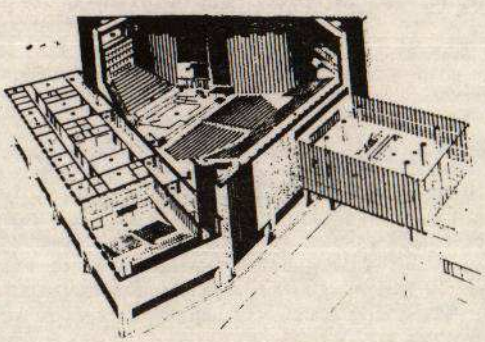
The lateral efficiency is not affected by the use of the curtains. This considerable change in reverb and articulation has meant that high efficient broadband speakers with limited array control can be used succesfully both for speech and shows.



Unfortunatly this shift in usage of the hall means a lot of extra handling when changing the hall from one situation to the other. This often results in a somewhat overcluttered ceiling over the podium area, when lights and battens with stored curtains and speakers are left in position at a symphonic music program. The triangular shaped choir area behind the orchestra has been stripped for chairs and is now also used for backscreening.

The concert hall qualities have not suffered to any noticeable degree, and the hall is still highly praised.

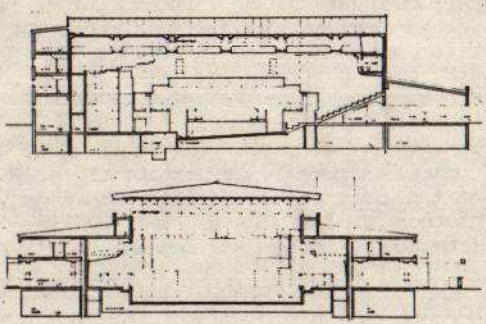
National Concert Hall,Dublin

Nearly the same story can be told for this hall. Intended as a pure concert hall it has turned out to be used also for all other type of arrangements, which can be performed from an open stage. The architecture of the hall forbids the use of hanging curtains and also the experiences from Oslo led to solve this type of performances solely by designing a suitable electro-acoustic system. This is based on a central cluster arrangement mounted on a hoist system, and again a console placed permanently and centrally at the back of the stalls. To facilitate the use of multi-miking and foldback speakers on stage, a curtain system can be drawn around the podium enclosing walls. This system does not affect the acoustic parameters, and the problems associated with the long reverbaration time is overcome solely by the tight array control of the speaker system.

NEW PROJECTS

Linköping Koncerthus (S)

This hall is being designed at the moment. The client, the municipality council, wants a pure concert hall, which interpreted means that no compromise must deteriorate the acoustical qualities for symphonic music. A CAD-program has been utilized to map the distribution of first and second order reflections, and a physical model in 1:10 scale is presently being investigated. Here EDT, Clarity (C), Sound Level (L) and Lateral Efficiency (LE) are the parameters being recorded.



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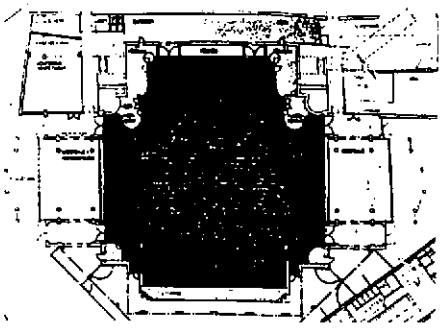
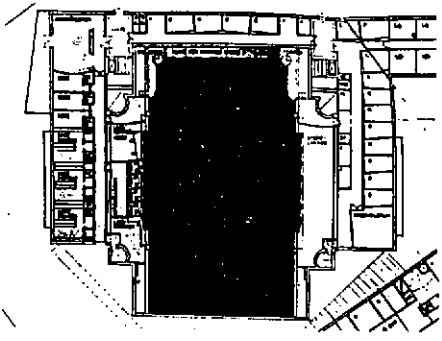
The hall is a 1200 seater with congress as second priority and third priority is for opera and musical type performances. A fixed volume of 15.000 m^3 (12 m^3/p) without roomchanging facilities but with a variable EDT/RT facility has been recommended and adopted. Further a permanent podium reflector-ceiling with fully opening flaps is intended, and also a variable podium enclosure wall system is being developed. These facilities are seen as essential in order to obtain the pure concert hall combined with the expected multipurpose use. EDT-values will averaged be at 1.9 sec.. Clarity values around -1 dB, Sound Level aimed at around +2 dB and LE-values around 0.3. The variabel acoustics is designed as a system of curtain tracks covering upto the entire exposed ceiling, this will give a maximum reduction of approximately 0.5 sec.





The town has no orchestra of it's own, but a music school with a permanent ensemble of around 40 musicians. The competing town Norköping has an orchestra around 75 musicians but no concert hall, and it is envisaged that these two ensembles will be the main users together with touring orchestra- and opera-companies from Stockholm and elsewhere. These widely different seized ensembles has led to the idea of developing a variable seized podium enclosure. The walls will be made of from 2-4 m high sculpture like partitions movable either on wheels or airbags in order that both small and large enclosures can be erected in an easy manner. At the same time an opera stage with full width and depth can be obtained, and a system of flies hidden above the podium reflector will be used for proscenium and props. The variable acoustics and a fully designed electroacoustic system with operational facility from the body of the hall shall ensure that both shows and speach can be performed satisfactory. It is hoped that this uncompromised concert hall design with the inbuilt multipurpose facilities will overcome the shortcommings encountered in earlier halls. From an acoustical point of view, the hall can seem rather wide, 26 m in the body of the hall and 46 m total in the side boxes. But actually this cut into the side walls has provided a very well placed effective early idereflecting surface comparable to a recessed balcony front. The preliminary model tests also shows very fine values of all parameters maybe with the exception of a position in the stalls close to the sidewalls, but this is not due to the side wall openings, but rather to features around the podium. This will be further investigated.

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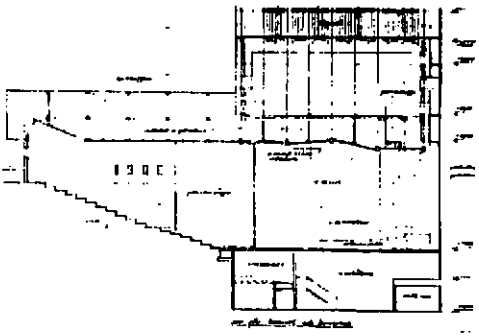
Umeå Culture House

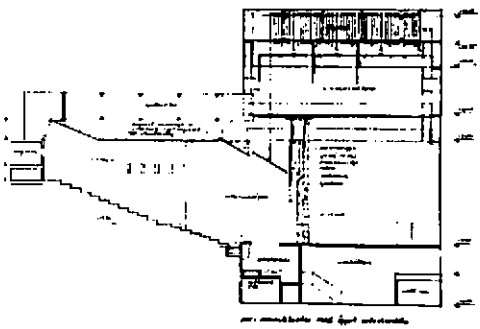
Another Swedish project under construction. This time with concert, opera, drama, shows and congresses all rated with the same priority. The reason why congress is always rated high in Sweden is, that you obtain governmental project subsidy to this function. With this true multipurpose use it is felt, that a fixed volume with a variable EDT/RT will not give satisfactory conditions for all type of performances, and hence an additional multiform concept has been recommended and adopted.

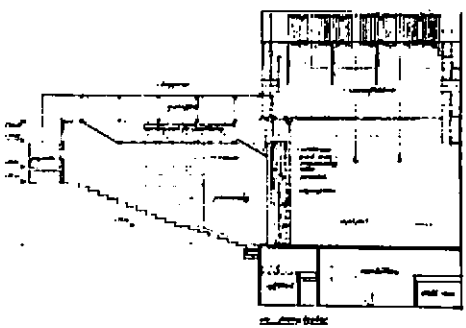
The hall will have 1100 seats for concerts, with the audience also placed on the stage, and 750 seats for opera and drama.

The basic idea is that the whole proscenium frame shall be moveable in order that an unrestricted continuous volume can be created for symphony concerts. In this case the proscenium frame will slide to the back of the stage, and the wings and soffit turned 90° so they create part of the orchestra enclosure. Additional moveable partitions will be added to this enclosure according to the size of the orchestra. The stage tower will be closed off with reflectors permanently hanging from flies in the tower. With this system the actual size and height, and hence volume of the concert hall can be adjusted to the type of concert, from grand orchestra with choir to a small ensemble. At the same time the sidewalls closing up to the proscenium can be turned to coincide with the sidewalls of the hall, and a desirable shoebox shaped auditorium with rising stalls will form the enclosure for concerts.

In the opera-case the proscenium frame is placed next to the orchestra pit, and the first positioned stage tower reflector creates the transition between the proscenium and the auditorium ceiling. A special feature in the hinged part of the sidewalls enables these







acoustically to maintain a parallel direction to the sidewalls while visually closing in towards the proscenium frame. This provides a proper build-up and balance of sound from orchestra and actors before the distribution to the audience occurs.

The drama situation can use the same proscenium position as for opera, but also a position further forward covering the pit is possible. For these type of plays the flaps on the hinged sidewalls will be closed and hence reflections will be radiated straight towards the audience, improving "Deutlichkeit". Also the variable acoustics consisting of curtains placed a long vertical baffles over the audience ceiling void can be automatically drawn, and the EDT/RT hence be reduced with approximately 0.5 sec.

The other type of performances can utilize the different shaping possibilities in combination with the variable acoustics, and by keeping the stage tower open the full 0.5 sec. variation can also be achieved in the concert hall configuration. This is considered important for large scale congresses, but again a complete designed electro-acoustic system with operational facility from the body of the hall is important for these types of usage.

Also in this case has the CAD-system formed a vital part in the acoustic design, and all the main configurations of the hall has been investigated for the first and second order distribution of reflections. A physical model in 1:10 has also been investigated but only based on the preliminary scheme (reported in the earlier mentioned book by V.Lassen Jordan). The present design of the hall being build differs somewhat from this original design, but not acoustically to a substantial degree.

The acoustic parameters aimed at are as follows:

	Concert	Opera	Drama	
EDT/RT	1.9	1.5	1.1	sec.
Clarity	-1	+1	+3	dB.
LE	0.3	0.3	0.3	

It could be argued, that all this changing around on walls, ceiling etc. is too complicated and is open for grossly misuse. On the other hand you can not create first class environments for the different type of performances without these facilities. The basic set-up for each type of performance will be properly documented both in written and pictured forms for the use of the house management, and it is felt that a sincere engagement by the technicians opens for valuable experiments and even more refined set-ups adjusted to each performance. Time will show, and it will be interesting to report later on the actual outcome.

Det Norske Teater

This hall falls a little outside the above recorded, since it is a pure theatre with priority for drama and musicals. It is an interesting project, because of it's extensive technical facilities for changing the form of the auditorium/stage according to the type of play. Basically it is a 750 seater steeply raked auditorium with extended seating facility on wagons on the stage for elizabethian or arena stage performances. This brings the total number of spectators to 1100. The theatre will open in Oslo this autumn with the musical

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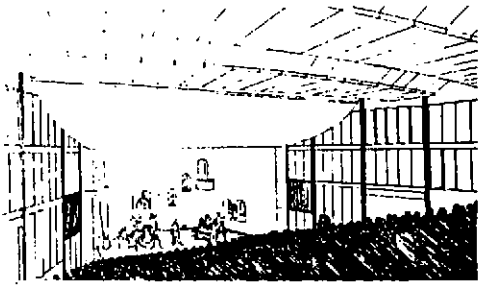
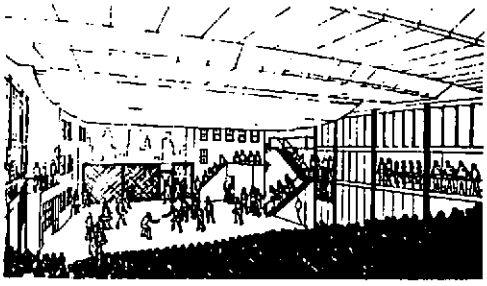
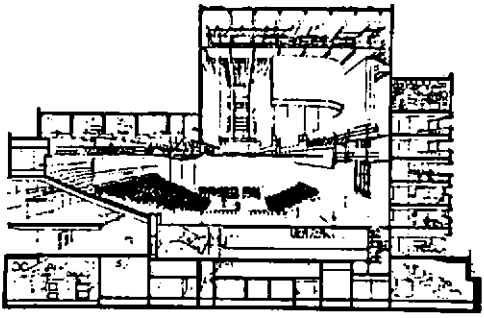
"Cats". All building structures around the proscenium area can be moved, somewhat similar to the Umeå Culture House, but vastly more technically sophisticated. Incidentally, it is the same teatre consultant who has worked on both projects.

The sidewalls are hinged back in the auditorium together with the proscenium ceiling reflector giving the facility to form both a narrow and wide proscenium opening. The sidewalls have three levels which move with the wall and the walls are sectionized into small elements which can be turned or slid away altogether. This gives the facility both to play music hidden or openly on all levels or even part of the play. Likewise the stage floor can in sections be placed in different heights, and an orchestra pit be formed either centrally or at either side of the proscenium. This type of auditorium is naturally very difficult to examine in all details for it's acoustic properties. But again the main configurations have been tested both in a physical model in 1:10 and by a CAD-program, the latter has been performed by ELAB, the acoustics lab. in Trondheim, with whom the acoustic consultancy is shared on this project.





It has not been posible to measure in the finished hall yet, but we are aiming at a rather high EDT/RT value around 1.3 sec. A variable acoustic system is not included, since the difference in optimal values between musical and drama is small, and the steep raking will ensure high values of "Deutlichkeit". The same system as in Umeå of fly hung reflectors have been designed for closing off the stage tower, when audience is placed on the stage.



An elaborate electro-acoustic system has been designed, and with the limited seating area it was decided not to have the mixing console placed in the audience but centrally on the second light bridge. This position is only two meters above the back row because of the steep raking.

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CONCLUSION.

It is recommended that the use of halls are carefully investigated and priorities are established on this basis. That the acoustic design aims at optimizing for the first priority, choosing acoustic parameters with optimal values for this usage. The choice of EDT/RT is regarded as the most important. Preferably the design of the hall should be investigated either by the aid of a CAD-program or a physical model or both. This is increasingly important the bigger the hall and the audience number is, at least from around 800 persons and upwards. In this regard it is important to work with ample volume per person, preferably 10-20% above recommended values, since the comfortable seating requirements of to day often covers a 10-20% bigger area than earlier spacing did. This holds especially for small numbered audiences. Also to-days bigger seized podium areas calls for a close examination of early reflecting areas around the podium. The acoustic consultant should also be responsible or involved in the design of the electro-acoustic system, preferably in conjunction with the sound technician. It is vital that the design of the system can cater for all lower listed priorities, and in this regard at least one operational position centrally in the audience area must be available. The system design can also take advantage of the CAD-program, or other similar programs mapping the sound distribution from the planned loudspeakers. A centrally placed cluster with high efficient speakers is thought preferable to sophisticated systems using distributed speakers with time delay or stereo imaging features.

For concert hall projects it is regarded as necessary to be able to reduce the EDT/RT for lower listed priorities and especially to damp down the podium area when multi-miking and fold-back are envisaged. This deadning should be effective in the frequency range of 250-4000 Hz.

References

(1) V.Lassen Jordan: Acoustic Design of Concert Halls and Theatres. Applied Science Publishers, 1980.
V.Lassen Jordan: A group of objective acoustical criteria for concert Halls. Applied Acoustics 14 (1981) p.253-266.
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