LISTENING AND DYNAMICS – SOME CHALLENGES WITH A HIGHLY ABSORPTIVE STAGE ENVIRONMENT

S. Folkvord COWI AS, Trondheim. Norway
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1 INTRODUCTION

Traditional measures to handle stage acoustics for amplified music, especially on small stages, will include excessive absorption. One underlying assumption often seems to be that a highly absorptive stage area in general will be a sufficient solution for amplified music. This is understandable, and to some extent even logical, as an acoustically extremely dry stage eases the sound engineer's task of controlling sound levels from various instruments and amplifiers, especially for ensembles producing very high sound levels.

This approach may, however, in certain situations create some challenges for the musicians, regarding issues such as internal listening, timbre, sound levels and dynamic range. In the following, these aspects are considered with a perspective on the performers' musical and acoustical challenges in such a stage environment.

2 THE HIGHLY ABSORPTIVE SMALL STAGE ENVIRONMENT

2.1 Sound levels

If most surfaces close to a small stage are absorptive, one distinct result of this will be that the general sound level is reduced locally. This is generally a desired effect, for several reasons. To name a few: Stage sound levels will generally be reduced to a (more) acceptable level, input signals to microphones become clearer, and the loudspeaker system will have an increased influence relative to the direct sound from stage, making it easier for the sound technician to control the sound distribution to the audience zones, and the balance within the ensemble.

2.2 Internal listening on stage

When reflections from stage surfaces are eliminated, the direct sound will be the only source for acoustical sound distribution on stage. In that situation, the internal listening will be strongly affected by interference of sight lines. When instruments, amplifiers and other equipment are included on stage, sight lines may very well be cut off, resulting in a reduction of auditive contact between musicians. Note that this is more than a matter of sound levels; the frequency characteristics of the sound is an equally important category here. Blocking of sightlines will mainly be audible in high frequencies, and reduced internal listening in this range may reduce the musicians' possibility to grasp nuances in time and timbre information, which predominantly consists of high frequent content.

These challenges are often solved by using monitor systems. The traditional solution is monitor speaker systems (wedges). In recent years, in-ear monitor systems (ear plugs with balance adjusted individually for each performer) have become increasingly frequent in use.

2.3 Lack of internal listening compensated with monitor loudspeakers

The purpose of the monitor speaker system is to ensure that each performer receives sufficient auditive information to perform with confidence and sufficient precision – in any musical sense. The gains are obvious – the performers on stage get to hear essential information that otherwise would be unavailable.

Using such systems, there is a risk that sound levels on stage increase to an undesired level. In genres with a massive sound production, and perhaps especially with sound technicians and/or musicians that are not aware of this problem, sound levels will inevitably increase when performers individually start to ask for a little more of a given instrument in their monitors. (Asking for *less* is, unfortunately, far less common, as most sound technicians in such venues will be able to confirm.)

This is, however, not a problem only in rock concerts. In ensembles typically generating far lower sound levels than a typical rock band, the monitor speaker systems also will have potential to affect the dynamics.

2.4 Lack of internal listening compensated with in-ear monitoring

Similarly as for the monitor speaker systems, the in-ear monitoring systems are used to ensure that the performers hear what they need to perform with the desired quality.

The in-ear system is a preferred solution for big, loud concert productions. These systems ensure large flexibility for moving on stage, as the received signal to a large extent will be unchanged, independent of the performer's position on stage. Such flexibility is essential i.e. for rock concerts on large stages, musicals, concerts with choreography etc. With the in-ear systems, performers are allowed to be significantly more mobile than in the days when the monitor speaker systems were the most frequently used technology.

3 MUSICAL CHALLENGES

3.1 Auditive communication in general

It is quite a demanding task to describe the needs for auditive contact between musical performers, as these needs are both dependent on musical genre, and variating individually between performers. However, a (necessarily simplified) starting point is presented below – a summary based on a mix of the prejudices and experience of the author and his discussion partners:

Symphonic ensembles:	Orchestra musicians need audible indicators. Precise perception of musical time is very important. Timbral information is essential within instrument groups. In general, performers tend to delegate responsibility for the total result to the conductor.
Pop/rock bands, stage productions	Musical content and delivery is to a large extent pre-planned. Precise perception of musical time is critically important in the internal listening. Responsibility for balance and overall ensemble sound is delegated to the sound engineer.

Chamber music ensembles	Each musician is in part responsible for balance, time and timbre. Hence, the ideal situation will be that the performers perceive the ensemble's sound as a whole, with relatively high proximity to the ensemble sound in the auditorium.
Small jazz ensembles	The basic internal listening needs tend to be quite similar to the chamber music ensembles. However, the sound levels are typically much higher, which makes it more challenging to achieve sufficiently good listening conditions.
Choirs	Pitch information is critically important. Therefore, reflection support is required internally between all performers on stage. Precise intonation is challenging in a stage environment lacking reflection support.

3.2 Musical time

When considering concepts and phrases like "*references to musical time*", this generally refers to elements in the sound that indicates where in time the musical pulse is placed. Typical examples are the attack of the bow of a violinist, the sound from a hi-hat cymbal, the start of a cyllable from a singer.

However, to clarify for readers who have limited experience from musical ensembles, it should be stated that musical time and pulse are very flexible concepts. Obviously, tempos may fluctuate, whether or not the sheet says *rubato*. Also – probably a less discussed topic - a musician's placing of a singular note in relation to the pulse is sometimes a function of the requirement of the style or genre, and, within some styles, an individual choice with various aesthetic and practical consequences. This topic will not be discussed in detail here. However, some typical examples, that may be identified by a keen music listener, are mentioned:

- Comparing the performance of a string quartet by Mozart with, say, one of Brahms, may be a relevant example. In Mozart, the musicians' accentuations will in general be strongly correlated to an even pulse, often in a constant tempo. In romantic string quartets like Brahms', the performers will have a much less rigid attitude towards tempo, as the music requires a more flexible approach.
- In almost any high-level performance of traditional Cuban salsa, one will find that the basic percussion instruments (with one or two exceptions, where some participants having a somewhat rotating free role) solely deliver accents consistent with the framework of subdivisions of the musical pulse, while soloists, and even several other instruments, may have a much more flexible orientation towards the pulse. This constitutes a constant tension between a steady rhythmical mosaic and a melodic, free approach, which is very much characteristic for the genre itself. Performing this music will require optimal internal listening conditions, as keeping track of all these parameters in real time is a complex effort.

3.3 Dynamics

In an ideal situation, listening conditions on stage are sufficiently good, so that no monitor systems are necessary. This is, however, not always the case. In the following, we look at typical dynamic challenges for a small ensemble performing improvised music.

3.3.1 Monitor speakers

Using a stage monitoring system inevitably introduces a risk of losing dynamical range for the musical ensemble. This is particularly the case for ensembles performing music where very low sound levels are frequently used for musical and communicative effect. Typical examples can be found in modern electroacoustic music, and in various forms of improvised music.

It is difficult to single out which chain of reasoning or actions that are in play here. However, some experienced jazz musicians and some similarly experienced sound technicians will agree that a monitor speaker system – unless used with skill and extreme carefulness – will have a tendency reduce a jazz ensemble's dynamic range significantly.

In a situation with a, say, 3-6 piece band with too much return from the monitoring system, the band sound that the performers hear is no longer the sound and timbre of the ensemble; it is the sound and timbre of the ensemble plus amplification. One needs to be very aware of the musical challenges this creates. If sufficient care is not taken, one will probably end up in a situation where the performers have lost contact with the ensemble's "zero level", meaning the lowest dynamic level within their expression range. A typical consequence is that the lowest dynamic level gradually increases. Several of the readers will have experienced such gigs as a listener. When a genre depending on (also) dynamic variation is performed in a situation where the lowest dynamic level available appears to be a strong *mezzoforte*, there is a danger that the music will appear monotonous, and the music in general becomes much less interesting than it could have been under more suitable conditions.

Another challenge in such a sound environment is the risk of overplaying, meaning that individual performers end up playing louder than the music requires, because of a lack of contact with the overall balance on stage and in the hall.

3.3.2 In-ear-monitoring

As mentioned, in-ear-monitoring is very efficient for large productions on large stages. Also, it is generally considered to work well for pop/rock bands on smaller stages.

However, these systems are not suited for all kinds of music. For example, for jazz ensembles, in-ear monitoring may lead to severe musical difficulties.

One of the main problems is that the performers, in particular on wind instruments, will have difficulties with controlling their own sound/timbre, in a situation where they partly get the response from their own instrument, partly from the stage acoustics and partly from a speaker inside the ear. The resulting sound image may vary quite a bit from their perception of their own timbre in another environment.

4 HOW TO DEAL WITH SUCH MATTERS - TECHNICALLY

A typical arena where the mentioned challenges are commonplace, will be on stage in a small to medium-sized music club. So, how should the stage environment be designed to address the problems discussed above?

- In general, walls and ceiling should be oriented with angling, so that parallel surfaces on stage are avoided, and sound is distributed out of the stage area.

- Reflecting surfaces should be sound scattering – that is, not diffusing, and not large, straight surfaces without geometrical variation. Diffusing surfaces do not create useful reflections, and reflections from a straight surface (i.e. a back wall) are in general too strong, creating problems both for internal listening and for microphone signals. So, smaller flat or concave surfaces, in a geometric pattern developed in collaboration with the designers, should be preferred.
- Variable absorption must be available. No matter how much thought that has been put into the design of the acoustic treatment of the surfaces on stage, situations will occur where maximal absorption of every surface is the only viable solution – both for musical and sound technical purposes and for pure health considerations.

5 HOW TO DEAL WITH SUCH MATTERS - MUSICALLY

In any stage environment, the musical ensemble (almost in any genre, apart from the loudest ones) may consider the following:

- Optimize placement on stage for internal listening.
- Start the sound check without variable absorbers, i.e. curtains, exposed.
- If it turns out that monitor speakers must be used, focus on keeping the total level low.
- When adjusting balance, ask for lower levels when possible!