STOP TEACHING ACOUSTICS, TEACH WHAT "ANNOYING" SOUNDS LIKE

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Anyone who has worked as an acoustical consultant knows that if you do your job perfectly, you may be thanked & receive an accolade, or more likely – simply receive no feedback. But if you messed up, you’ll not hear the end of it until it’s fixed. This author believes this is a result of the architects & owners valuing the visual features of a space over the acoustical features, and in many cases, rightfully so. In this author's experience, it's frequently because acoustics is misunderstood (as opposed to wilfully ignored). This cannot be entirely blamed on architects because hitting an NC target isn't something fundamentally compelling (even if necessary). Architects know when something looks bad, so they actively avoid it. It's not as certain if architects appreciate when something will sound bad (particularly if framed in an abstract acoustic metric). As such, the author's approach to teaching practicing architects about acoustics has been the opposite of conventional education. Terms such as NC, STC, TL, SIL aren't remembered but hiss, rumble, screech, booming & shouting seem to stick. In this session, the discussion will focus on how the negatives of acoustics can be used to accomplish the desired outcome, making architects understand the importance of good acoustics.

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1. Introduction

For architects in school, an acoustics course typically has a large portion of the subject matter dedicated to understanding decibel levels, human hearing concepts and good acoustic metrics for spaces. It’s also pretty common within the course to have the architectural students complete a project around some type of acoustically significant building or space, noting the characteristics (both architecturally and acoustically) that make it renowned. At the end of the course, there’s usually an exam to test and reinforce the idea of these acoustic metrics and their importance in designing a good building. Unfortunately, from experience, after a few years working in the industry, unless it’s a Performing Arts Centre (PAC) or some other very acoustically significant building, these concepts aren’t at the forefront of practicing architects.

1.1 What acousticians typically bring to the team

I have worked on projects that range from smaller venues such as patios and community centres, to large scale spaces such as PAC and large-scale university lecture halls. As the acoustical consultant on the project, it’s typical to work with the design team and prepare a Design Brief that outlines the targets. For the acoustical design brief, this will typically include room dBA & NC levels, partition STC metrics,
room RT targets, maybe even SPP/SIL metrics. If there are spaces that require more specific acoustic metrics, we may include distinctness (D50), acoustic strength (G) or other applicable metrics.

When speaking with architects, or others on the design team, my opinions are not questioned and it’s clear that the design will target these metrics, but I know there’s a lack of true understanding what these metrics mean, and what the end result will be (other than “it’ll sound good”). From experience, I know there’s very little comprehension of what NOT hitting these metrics mean. For example, an acoustician knows achieving NC-27 instead of NC-25 isn’t that critical, but getting an RT of 2.5 instead of 1.5 is a major issue. This insight isn’t common knowledge outside of the acoustics world, and educating with just the numbers doesn’t stick.

1.2 What Architects are taught

I’ve presented at various architecture and interior design conferences, as well as offered courses and lunch & learns, and I often quiz the audience members using the terms shown below. Most know the terms in the 1st row however in all the presentations, I’ve only had a handful of people know the terms on the 2nd row, and I’ve never had a single person know any terms on the 3rd row. These are from designers and architects who’ve been right out of school to those working for many years.

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<th>Table 1: Various acoustic metrics</th>
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If this is all that people know about what acousticians do, how can we expect them to truly appreciate a well-designed space. What can we change in the teaching of acoustics so that acousticians can continue applying the scientific principles to what we do, while ensuring those we work with understand what they are getting, without making them become acousticians? Do we really need architects or designers to know that calculating the STC means knowing the sum of deficiencies must be not greater than 32 points, or no individual 1/3 octave band is 8 points below the STC curve? Leave that to the acousticians and teach everyone else what happens if you don’t block out the noise!

1.3 What needs to change in teaching acoustics

I’ve started changing how I give presentations to non-acousticians. I often talk to the AV team or subtly place speakers in the room to raise the ambient to level that’s not usually perceptible but beyond acceptable (for the technical, an NC-50 with a low frequency rumble). I typically start my presentation and am a few minutes in before asking if anyone has a problem with the acoustics. I typically don’t get any negative feedback (perhaps a reflection of the low standards in most presentation spaces) – people just accept the defector acoustics. I then turn off the artificial noise and there’s a wave of surprise on most peoples’ reactions. What wasn’t a problem before is now clearly perceptible, and if I reintroduce the noise, it’s unacceptable and distracting. At that point, I don’t need to spend another second explaining NC levels or dBA or any other number.

2. Acoustics in Education

To change the teaching of acoustics, we need to introduce new ideas – the meaning of good and bad acoustics. We still have to ensure people know numbers, the metrics, but we need to expand that to ensure architects and designers know and feel what the numbers mean. What are some ideas we can bring forth?
2.1 Modern ideas

An architectural school will have a lot of photos, scale models and other physical media that demonstrate the visual but unless that same school has a robust acoustics program, it’s not common to have spaces that have varying acoustics. Perhaps the concept can be taught by making students simply listen to good and bad acoustics. It’s not an ideal solution given the variety of listening options (i.e. types of headphones) but this author believes it’s something that will be an effective tool in teaching.

2.1.1 Auralizations and Listening rooms

A number of acoustical consultants have brought forward techniques such as creating acoustic files or auralizations, intended to allow the users to “hear” over headphones, what the room will sound like once constructed. Many have also built full listening rooms, able to bring in groups of people into a space to hear the design intent. In this author’s opinion, this is a major improvement in the education of acoustics, moving away from numbers on a piece of paper to providing an opportunity to educate on the impact of good acoustics. This author isn’t certain if there’s a list of these types of rooms that exist, but it’s worth compiling this list and bringing students to these rooms – a practical field trip where various acoustical environment can be reproduced, not just that have these listening rooms, but for schools that don’t have these rooms,

2.1.2 Bad acoustics

A lot of time is often spent on a project where the student must pick a famous building, with respect to acoustics, and prepare a written summary of the characteristics of the space. Aeracoustics is often contacted to provide feedback on spaces such as the Queen Elizabeth Theatre. This is an effective technique to teaching students about the best there is of acoustics, but there’s also a lot to learn from failure. There aren’t too many acousticians who’ll willingly volunteer a project that didn’t meet expectations, but there’s lots that know of spaces where no acoustical consultant was retained, and the results speak for themselves. Imagine a day spent asking students to find poor acoustics? Some easy ideas - spend even thirty (30) minutes in a loud restaurant and try to have a meaningful conversation with a group of >5 at a table; attend a play held in a school gymnasium; setup a skype call with a large group from one office to another and ask various person around the room to read some text, and ask the receiving room to transcribe the words; choose the professor’s office and hold mock interviews or mock HR conversation, and ask those outside or sitting in adjacent offices how much of the conversation they can overhear. In all the scenarios, there’s no presumed knowledge about background noise levels, articulation index, speech privacy class, transmission loss or any other acoustic metric, but relating these ideas to why each of the spaces failed to meet acoustic expectations will be immediately relatable.

2.1.3 Can they hear the numbers?

There’s quite a number of online videos that showcase people singing in different spaces in order to demonstrate the effect of varying metrics (typically Reverberation Time). There are also quite a number of programs that can simulate varying effects (talking in a stone room vs. a carpeted room). These are very effective tools to demonstrate WHAT the metric means, but why not take it a step further? Imagine challenging students or working architects and designers to actually try to put a number to what they hear? Why not change the numbers and ask when they notice a difference? This takes a significant amount of time and coordination but can be very effective in not only teaching what the metric is, but the sensitivity of the numbers themselves.

2.1.4 Right metric, wrong space?

Finally, what about the wrong use of a room? Everyone wants a multipurpose space that can hold a meeting, hold a play and hold a classical music concert. There’s nothing wrong with trying to optimize uses of a space but there needs to be an understanding of the trade-offs. Sometimes an effective exercise
is having people experience a perfect room (e.g. a world class PAC) and then an average room, and asking how the experiences differ.

A surprisingly effective tool is taking a group and trying to hold a meeting in the audience seating area of a theatre. A space that many would consider “acoustically perfect” isn’t conducive to holding a meeting. This example really solidifies the understanding that the “right” acoustic metric for one space isn’t the “best” for another, and that the correct design must work for the use of the space.

3. Connecting acoustics to emotional response

Some of the ideas presented here, when it comes to teaching acoustics, is all about connecting the theoretical and mathematical aspects of acoustics to the emotional response to sound, to the visceral understanding of what the sounds mean and how it affects people.

It’s difficult to compress the volume of knowledge in the field of acoustics to a single 12-14 week university course. There are minimums that any architect or designer must know in order to practice in their field, but this isn’t to say there’s more than can be included to provide an appreciation for more than the numbers.

When learning about colour palettes, architects don’t learn about luminosity and the wavelength of colours – they learn about what colours mean and what emotion the colour elicits. They learn what colours work best for the space, whether it be for concentration, for disappearing into the background, or for being the focal point of the space. When teaching acoustics, we need to introduce a similar concept, making sure the if a required emotion or environment is desired, that the acoustics works towards that goal, not the goal of a numeric metric.

REFERENCES