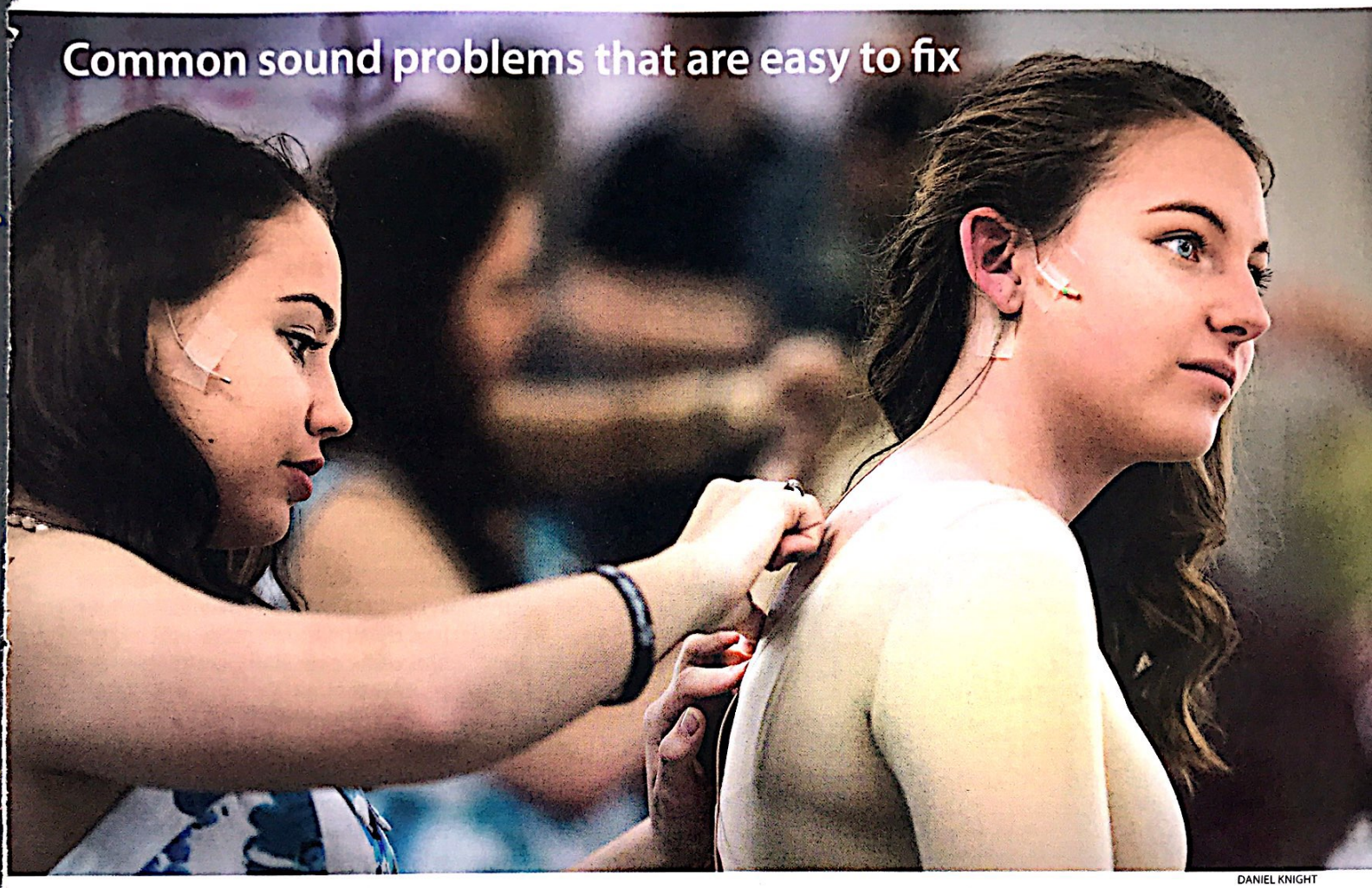
Troubleshooting wireless mics

Common sound problems that are easy to fix



DANIEL KNIGHT

BY DANA TAYLOR

Alyssa Juncker, left, helps secure Gabby Gilligan's mic cable before a performance of Big Fish *at the author's school.*

ON ANY GIVEN night, many of the people in your audience won't have much to say about the quality of the scenery, the lighting, the choreography, or even the acting—but everyone will have an opinion about the sound.

Wireless microphones have become ubiquitous in theatrical production and for some of us, the bane of our existence. Every wireless mic system can encounter problems, and for the most part, the problem is us. We create issues in our systems by failing to understand the basics of how wireless mics work and how they react to the physical space and to each other.

Yet there are relatively easy solutions to four of the most frequent problems: dropout, RF or radio frequency issues, phase coherence issues or comb filtering, and intermodulation. A little bit of homework will save a great deal of frustration and lost rehearsal time.

Dropout is the momentary loss of transmission signal. It is the most common problem associated with wireless mics. Some typical causes of dropout include multipath (multiple versions of the same transmission

reaching the antennas at different times), radio frequency interference, and line of sight problems (the blocking of transmission signals by set pieces, curtains, or actors).

Multipath can be thought of as a transmission echo. When we hear something from two different sources at slightly different times (even just milliseconds apart), we find that what is being said becomes unintelligible. When wireless transmissions reach the receiver antenna at slightly different times, similar disruptions can occur. Most wireless systems utilize two antennas, which can help to eliminate the issue. It's not a cure-all, though. The receiver will seek the strongest wireless signal, and as it switches from one antenna to the other, you may still encounter momentary dropout or a "swooshing" sound, or both together. The easiest fix is to relocate your receivers closer to the actors. A more reliable fix, although a costlier one, would be to install a remote directional antenna system. These antennas gather wireless transmissions more efficiently and reduce or eliminate multipath problems.

RF or *radio frequency* issues involve interference from the astonishing number of transmission devices that surround us. These include smartphones, radio and television broadcast signals, two-way radios, hobbyist gadgets, data networks, and Wi-Fi transmissions. These devices likely do not transmit in the frequency range of our microphones, but the sheer volume of RF they create becomes an issue for the quality of transmissions. You could think of this random RF as we do "floor," or the ambient noise in a room. Sound systems need to be loud enough to get above the ambient noise. Similarly, our wireless mic transmissions need to get above the floor of all this other transmission noise. As with multipath, we can help the problem by moving our receivers closer to the transmitters and by using directional antennas.

we can also help by moving RF-producing devices like computers and smartphones from the areas near transmitters, receivers, and the sound board. The idea is to increase the signal-to-noise ratio. Cleaner signal, better sound.

I think cell phones probably get more blame for wireless mic transmission problems than they deserve. It is true that a cellular device near the mic/transmitter (like a phone in an actor's pocket) can create enough RF to cause trouble. So can a theatre full of cell phones. However, I believe we have adopted cell phone interference as our default answer for most wireless mic issues. Sometimes there are other things going on, and understanding them and their fixes, will improve our sound.

Sound is a range of frequencies, and the systematic, uninterrupted transmission of sound waves creates what we hear. When they are interrupted, we find the result less pleasing and natural-sounding. This common issue is called *phase incoherence* and often presents itself as a phenomenon called *comb filtering*. Comb filtering is best understood by how it sounds. When you start to hear a "hollowness" in the sound coming through your system, you have just encountered the issue. The hollow effect is created by frequency cancellation that happens when a sound reaches multiple mics at slightly different times. Some frequencies will effectively cancel each other, creating a series of sharp peaks and valleys (like the teeth of a comb). The valleys are the lost frequencies. Their absence creates the hollowness we hear.

Comb filtering can occur when two actors are speaking in close proximity. Each actor is picked up by her mic and then by her partner's almost, but not quite, simultaneously. The ensuing comb filtering can diminish the quality of the sound (and the quality of the dramatic moment). To mitigate the issue, turn off one of the mics. You may find it necessary to turn mics on and off throughout these moments, based on blocking and who is speaking.

The last issue is intermodulation (IM), and it relates to the creation of phantom frequencies when multiple wireless devices are used. Before discussing this issue, we must remember that only one wireless mic can be used on a transmission frequency at a time. Intermodulation occurs when two or more transmitters are on at the same time. The presence of two frequencies will create two additional "phantom" frequencies. These additional frequencies are likely strong enough to render their use as a transmission frequency for a third or fourth wireless mic untenable. Add more mics and the creation of these phantom frequencies grows exponentially. In years past, schools often had mismatched, sometimes borrowed, wireless systems. The poor coordination of transmission frequencies would result in distortion and dropout as mics tried to transmit on the same frequency, too near a frequency already in use, or in the same transmission range as the phantom frequencies created by IM.

Now, schools often buy systems with multiple wireless mics, and by following the manufacturer's recommendations can largely avoid intermodulation problems. If you are still using a mismatched system, an intermodulation software program can help coordinate your frequencies. This is much easier if you are using "frequency agile" mics (on which the transmission frequency can be changed).

Your microphone manufacturer will have how-to guides to better understand the successful implementation of wireless systems and FAQ's to help you troubleshoot problems. By getting a better handle on the most common issues, you can reduce a lot of tech week headaches—and avoid all those complaints on opening night. ▼

Wireless mic glossary

Common terms used by sound technicians:

Comb filtering. Loss of sound frequencies due to phase incoherence, often associated with one sound being picked up by two mics at slightly different times.

Diversity. Used to describe a wireless receiver with two antennas.

Dropout. Loss of transmission signal, the single most prevalent problem with wireless mics.

Floor. The ambient noise in a space or the RF noise that wireless transmitters must overcome to function effectively.

Intermodulation (IM or intermod). The creation of phantom frequencies when using two or more wireless transmitters.

Line of sight. The signal path between the transmitter and the receiver. Obstructions, which can include scenic goods, building elements, and even actors, can cause dropout.

Multipath. Wireless transmission signals can reach the receiver at slightly different times, typically because they have been reflected off surfaces prior to being picked up by the antennas. A common cause of dropout.

RF or radio frequency. General term for transmissions created by electrical devices, TV and radio broadcasts, and cell phones.

Useful publications:

Shure Wireless Microphone User Guide
http://cdn.shure.com/publication/upload/930/introduction-to-wireless-microphone-systems-english.pdf

Shure Guide for Theatre Performances
http://cdn.shure.com/publication/upload/394/us_pro_al1532_theater_guide_ea.pdf