Cupping The Microphone: How Microphone Handling Technique Can Affect Polar Response

Hannah Roberts
Supervisor Paul Bourne

Aims

The aim of the project was to investigate the effects of cupping the microphone, on the microphones polar response to provide evidence to justify the discourse surrounding microphone handling techniques.

Background

Cupping the microphone is a common complaint amongst live sound engineers across many professional and amateur audio forums. Entire threads have been dedicated to having discussions around how to combat the effects caused by cupping the microphone, with specific reference to how polar response is affected (Various, 2017) (Various, 2008) (Various, 2015).

Although in reality the polar response of a changes as soon as a microphone is picked up, problems usually occur when the grills or slots of the microphone are blocked (James, 2002); limiting high frequency response and simulating an enclosed back plate of a pressure microphone (Maland, 2015), which is inherently omnidirectional (Borwick, 1990). This variance in both frequency response and polar response can result in a severely reduced gain-before-feedback ratio or even reduced output at frequencies that aid intelligibility, often requiring heavy EQ to produce an acceptable sound (Maland, 2015).

Testing

The test performed was based on a lab from a 2nd year module, in which a microphone was placed on a stand approximately 1.5 metres away from a loudspeaker which was connected to a sine generator. A noise floor reading was recording and then at 15° increments from 0-180° the level in dBZ (dBSPL Z-weighted) was recorded for both 250Hz and 2kHz, this test was performed with the microphone uncupped and then cupped.

This method of testing introduced a great margin of error. Having to manually rotate the microphone stand by exactly 15° each time while remaining in the same spot is near impossible to do by hand, and using a real hand rather than a simulated one made it difficult to maintain a consistent grip position and strength throughout each of the tests.

This data was then input into an excel spreadsheet,duplicated for 180-345°, normalised and then used to create a radial chart for each microphone tested, combining both uncupped and cupped data onto a single graph. The data was duplicated as it is assumed the polar response of the microphone is mirrored.

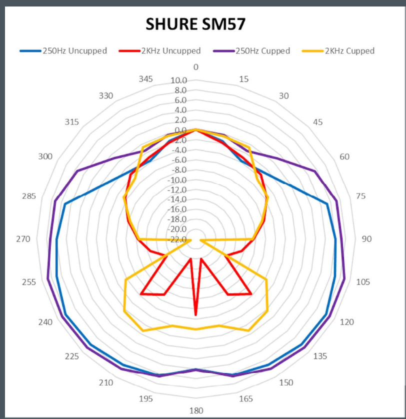

Figure 1.1

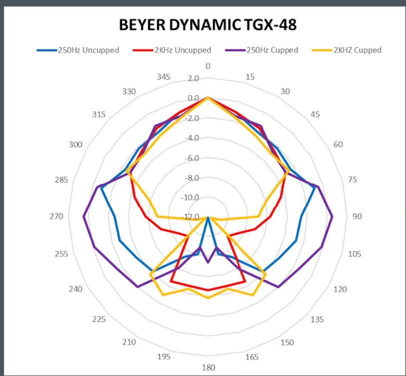

Figure 1.2

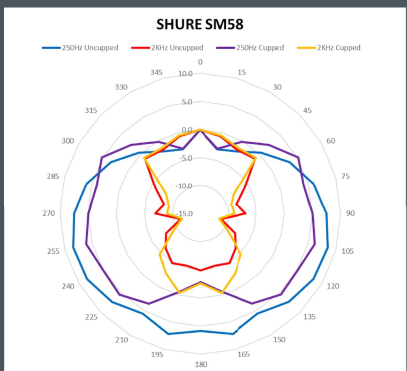

Figure 1.3

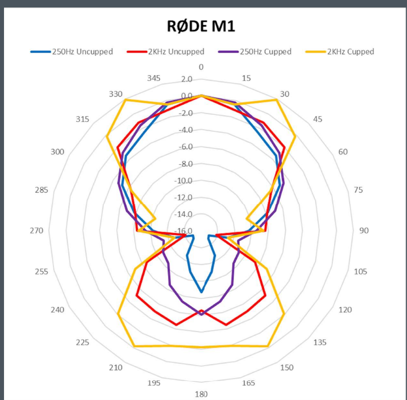

Figure 1.4

The figures above show the normalised data for each set of tests plotted on a radial chart in Excel.

Conclusions

Despite the various flaws in the method of testing the results show clear evidence that cupping the microphone does indeed alter the polar reponse by widening at both the front and rear, but at higher frequencies the affect is more significant than lower frequencies. However, recent research has shown the effect of cupping the microphone on frequency reponse, at higher frequencies to be quite drastic (DPA Microphones A/s, 2019).

Further investigation

I believe further testing is required to determine whether the discourse specifically regarding polar response is justified or if it s simply a side affect of the altered frequency reponse. Another alternate route of testing would be to investigate how the placement of lavalier microphones would affect the polar pattern and how this can be used effectively in theatre.

References

Borwick, J., 1990. Microphones Technology and Techniques. Oxford: Focal Press.
DPA Microphones A/s, 2019. PROPER HAND PLACEMENT ON A VOCAL MIC. [Online] Available at: https://www.dpamicrophones.com/mic-university/proper-hand-placement-on-a-vocal-mic [Accessed 3 May 2020].
Duncan, L., 2019. How to Hold a Microphone When Singing or Rapping. [Online] Available at: https://www.musicindustryhowto.com/how-to-hold-a-microphone-when-singing-or-rapping/ [Accessed 10 May 2020].
James, P., 2002. The Live Sound Manual. San Fransico: Backbeat Books.
Maland, D., 2015. Why Audio Humans Get So Bent Out Of Shape When A Mic Is Cupped. [Online] Available at: https://smallvenuesurvivalist.com/why-audio-humans-get-so-bent-out-of-shape-when-a-mic-is-cupped/ [Accessed 10 May 2020].
Various, 2008. Live Hip Hop -- Why do they cup the mic?. [Online] Available at: https://www.gearslutz.com/board/rap-hip-hop-engineering-and-production/335062-live-hip-hop-why-do-they-cup-mic.html [Accessed 2 April 2020].
Various, 2015. Advice on mixing mic-cupping rappers?. [Online] Available at: https://www.reddit.com/r/livesound/comments/2966rh/advice_on_mixing_miccupping_rappers/ [Accessed 17 April 2020].
Various, 2017. Question about mixing for a rapper and mic cupping. [Online] Available at: https://www.reddit.com/r/livesound/comments/4t7fan/question_about_mixing_for_a_rapper_and_mic_cupping/ [Accessed 19 April 2020].