What's the sound of a hundred thousand soccer fans?

November 27 2013

Mention vuvuzela to soccer fans, and they may cringe. The plastic horn rose to prominence during the 2010 World Cup in South Africa, where tens of thousands of those instruments blared in packed stadiums. The loud, buzzing noise soon became a major annoyance, disrupting players and even fans watching on TV.

Now, for the 2014 World Cup in Brazil, organizers have introduced the maraca-like caxirola as the official instrument of the event. The caxirola, based on the African caxixi, was invented by Brazilian musician Carlinhos Brown to be more subdued than the vuvuzela. To see if this was really the case, Talita Pozzer and Stephan Paul of the Federal University of Santa Maria in Brazil studied the acoustics of the instrument, finding that a single caxirola, at least, poses no threat to the user's ear.

Their work will be presented at the 166th meeting of the Acoustic Society of America, held Dec. 2-6, 2013, in San Francisco, Calif.

In their analysis, the researchers asked 22 volunteers who had never seen the instrument to play it as they thought it should be played, finding that people tend to either shake it along its longer axis or its shorter axis. A recording device placed at the ear of each subject measured the sound of the caxirola.

The researchers found that if shaken along the longer axis, the instrument produces twice the sound energy as when shaken along the

shorter axis. But because volume depends logarithmically on the sound energy, the difference is only just noticeable to the ear. In both playing styles, the sound pressure levels were comparable to that of a normal conversation – and roughly 45 decibels lower than that of the vuvuzela, corresponding to 1/30,000th times the sound energy. In other words, you would need 30,000 caxirolas to produce the same sound pressure level as a single vuvuzela.

The researchers also captured the acoustic signature of the caxirola played in both styles, measuring how the frequency and intensity of the sound varies over time. The signature was similar in both cases.

The next step, Paul said, is to measure the caxirola's sound power levels, which, unlike sound pressure levels, are independent of distance and the instrument's surroundings. The researchers can then input those measurements into a computer model of soccer stadiums, simulating exactly what kind of noise thousands of caxirolas would make, showing whether or not it would be harmful.

Since its introduction last year, the caxirola has already been mired in controversy. After disgruntled fans hurled the instrument on the field during a match in April, officials banned the instrument for the Confederations Cup last summer. Whether the caxirola will be distributed during the 2014 World Cup has yet to be determined, Paul said.

Perhaps it's not the caxirola's acoustics that's a cause for concern – but its aerodynamics.

More information: Presentation 4pMUa6, "A first look into the caxirola – official music instrument of the Soccer World Cup 2014," will take place on Thursday, Dec. 5, 2013, at 3:40 p.m. The abstract describing this work can be found here:

asa2013.abstractcentral.com/planner.jsp

Provided by American Institute of Physics